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Nakaue et al.

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(54) **DEVELOPER STORING CONTAINER, AND IMAGE FORMING APPARATUS PROVIDED WITH THE SAME**

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G03G 15/08 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/0877*** (2013.01)

(58) **Field of Classification Search**
USPC 399/107, 110, 111, 119, 120, 252, 399/258–263; 222/DIG. 1
See application file for complete search history.

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(57) **ABSTRACT**

Provided are a developer storing container, including a movable moving wall, and suppressing a developer from being leaked to a moving direction upstream side of the moving wall, and an image forming apparatus, provided with the same A toner container is provided with a container main body, a moving wall, a toner discharge port, and an inner wall seal. The toner container replenishes toner to a developing apparatus. The moving wall conveys the toner while being moved toward the toner discharge port inside the container main body. The inner wall seal forms an outer peripheral part of the moving wall, and is compressively deformed between an inner peripheral part of the container main body and the moving wall. A cross-sectional area of an internal space of the container main body is set so as to be decreased as a final position of the moving wall is approached.

7 Claims, 19 Drawing Sheets

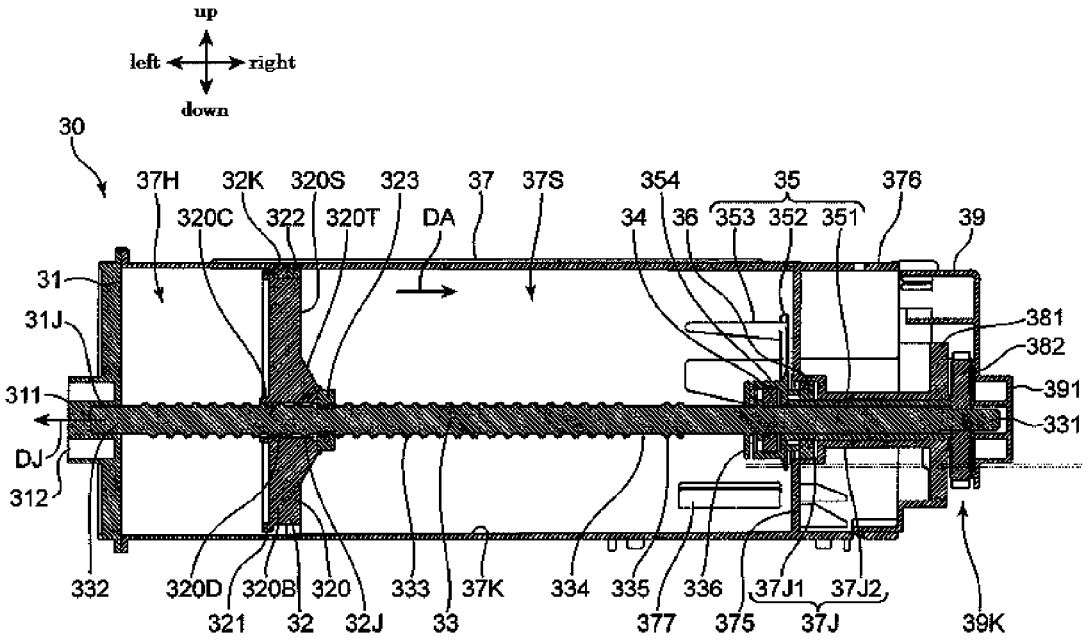
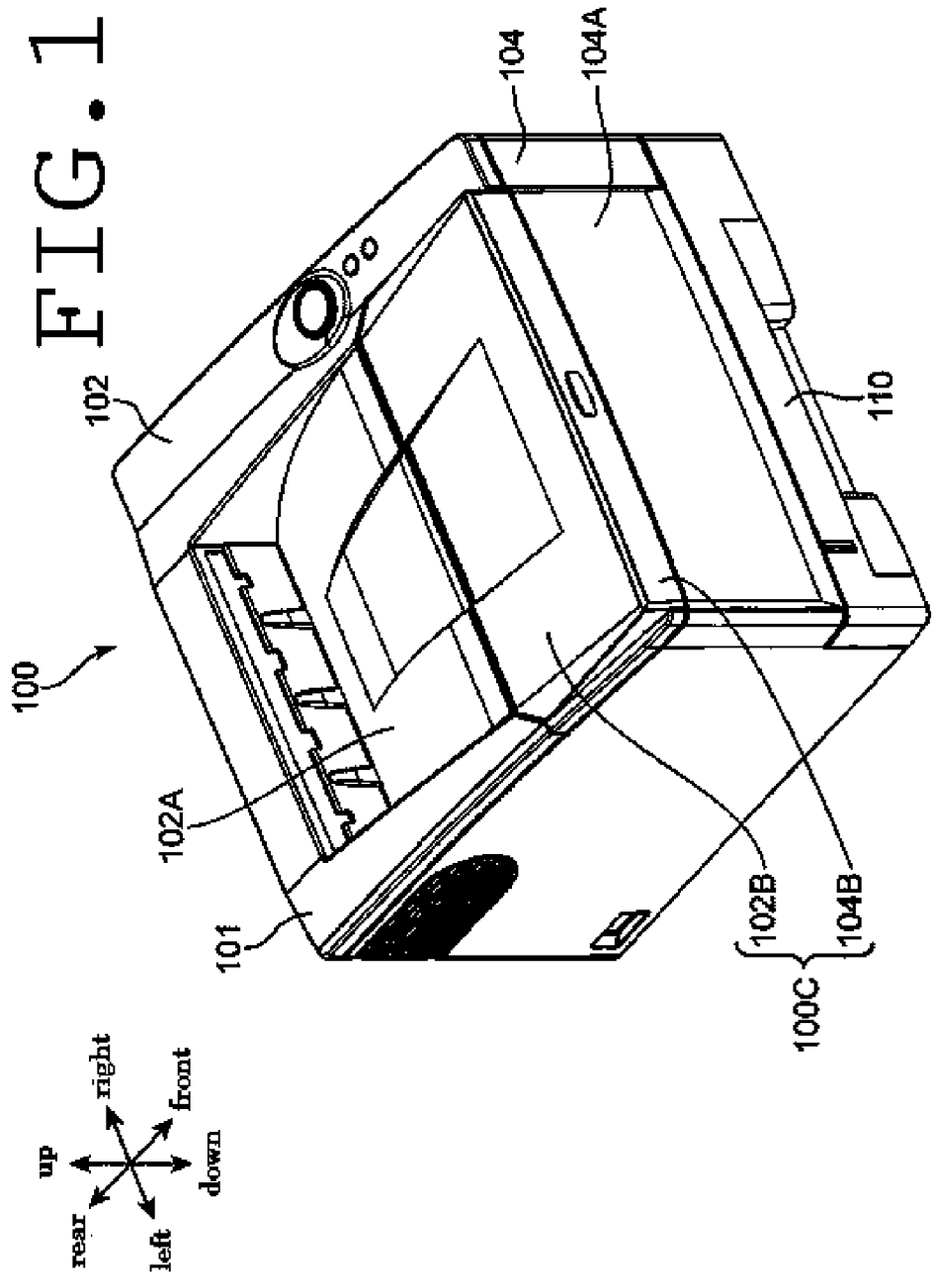


FIG. 1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100C
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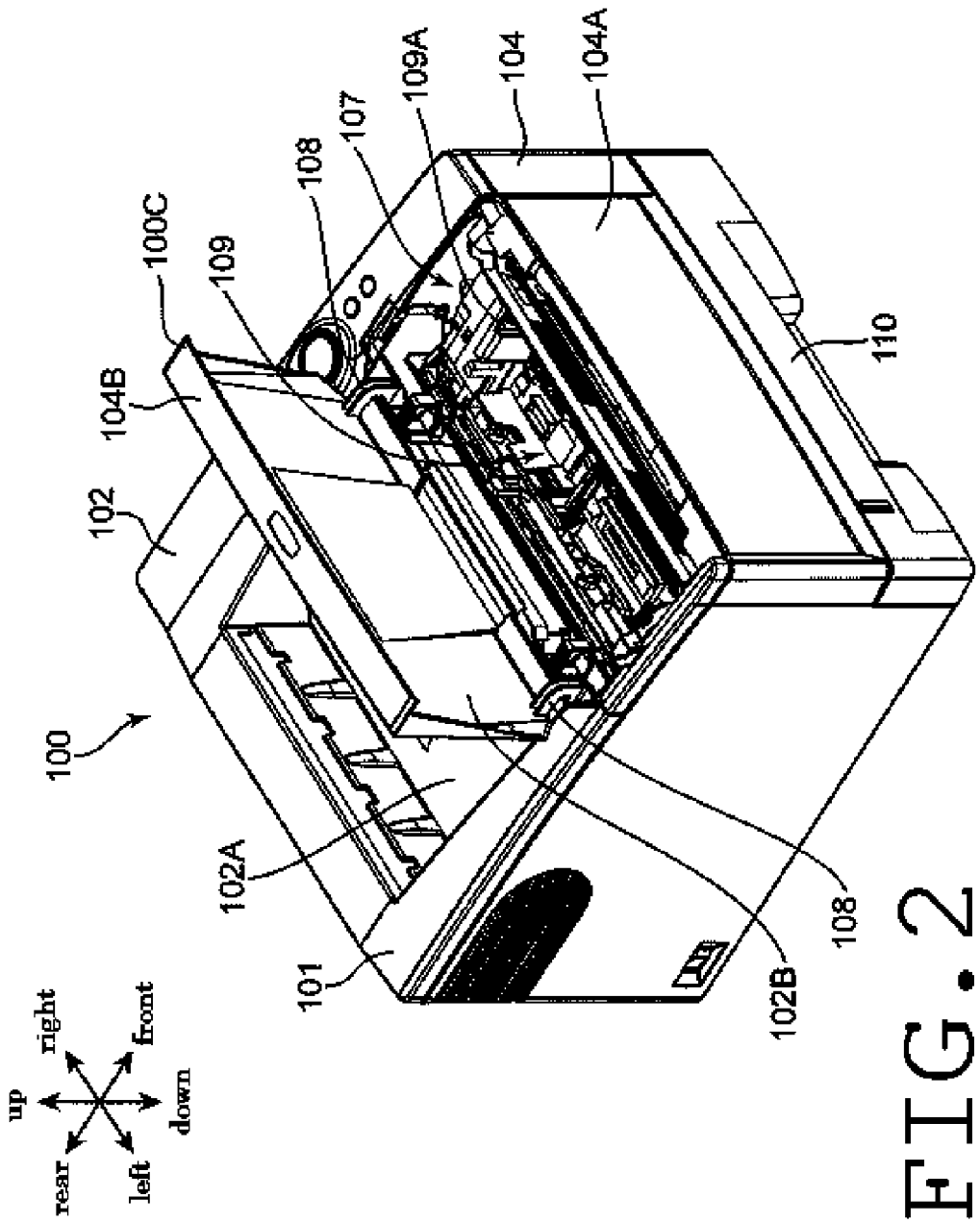
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104B
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108
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up
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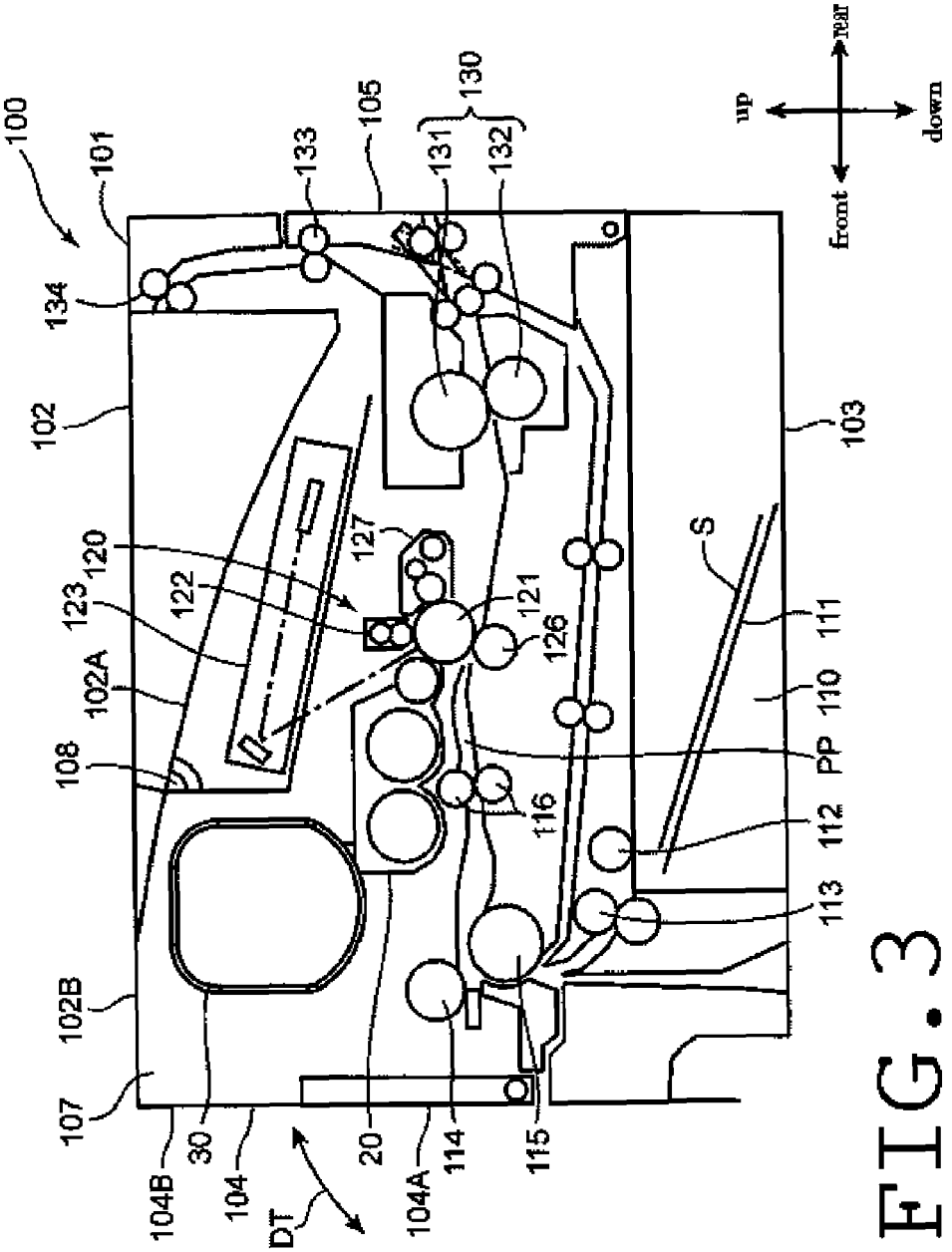
rear
left

FIG. 2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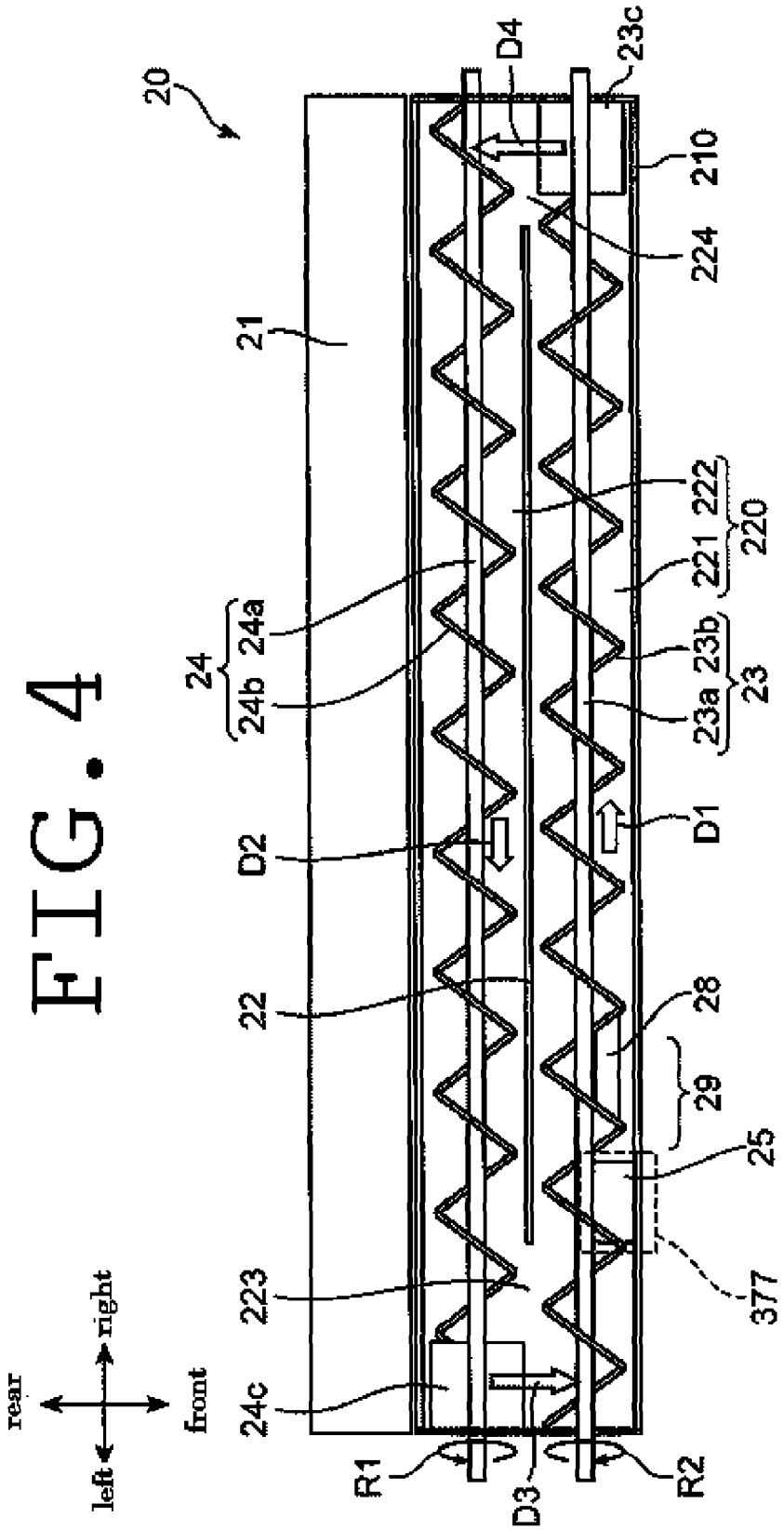
101
133
105
131
130
132
134
102
103
120
123
122
127
121
126
S
111
102A
110
108
PP
116
112
113
102B
107
104B
30
104
DT
20
104A
114
115
up
down
rear
front

FIG. 3

FIG. 4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21
22
223
24
24a
24b
24c
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D4
23c
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224
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23a
23
D1
28
29
25
377
R1
D3
R2
rear
front
left
right

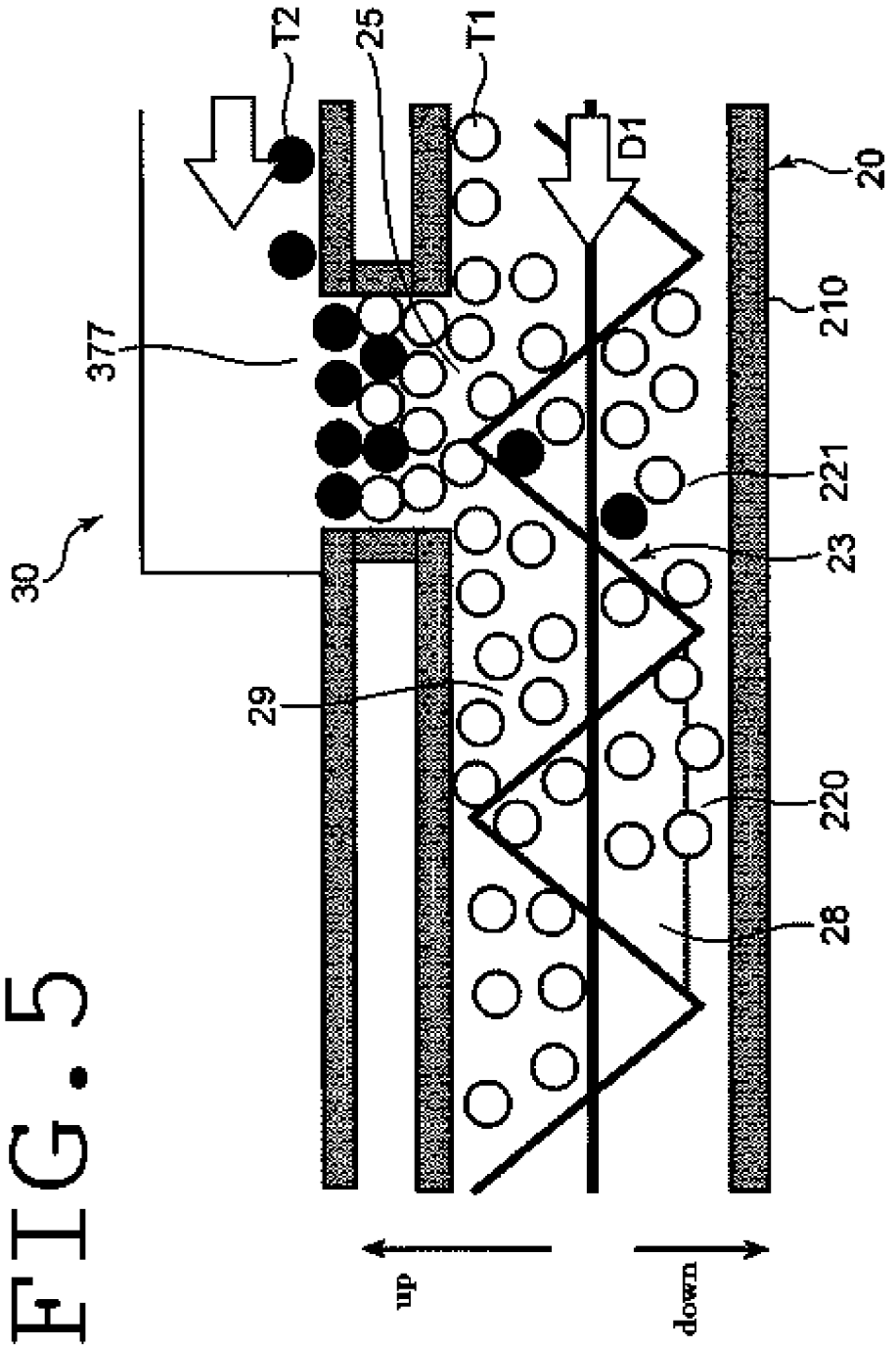


FIG. 5

FIG. 6

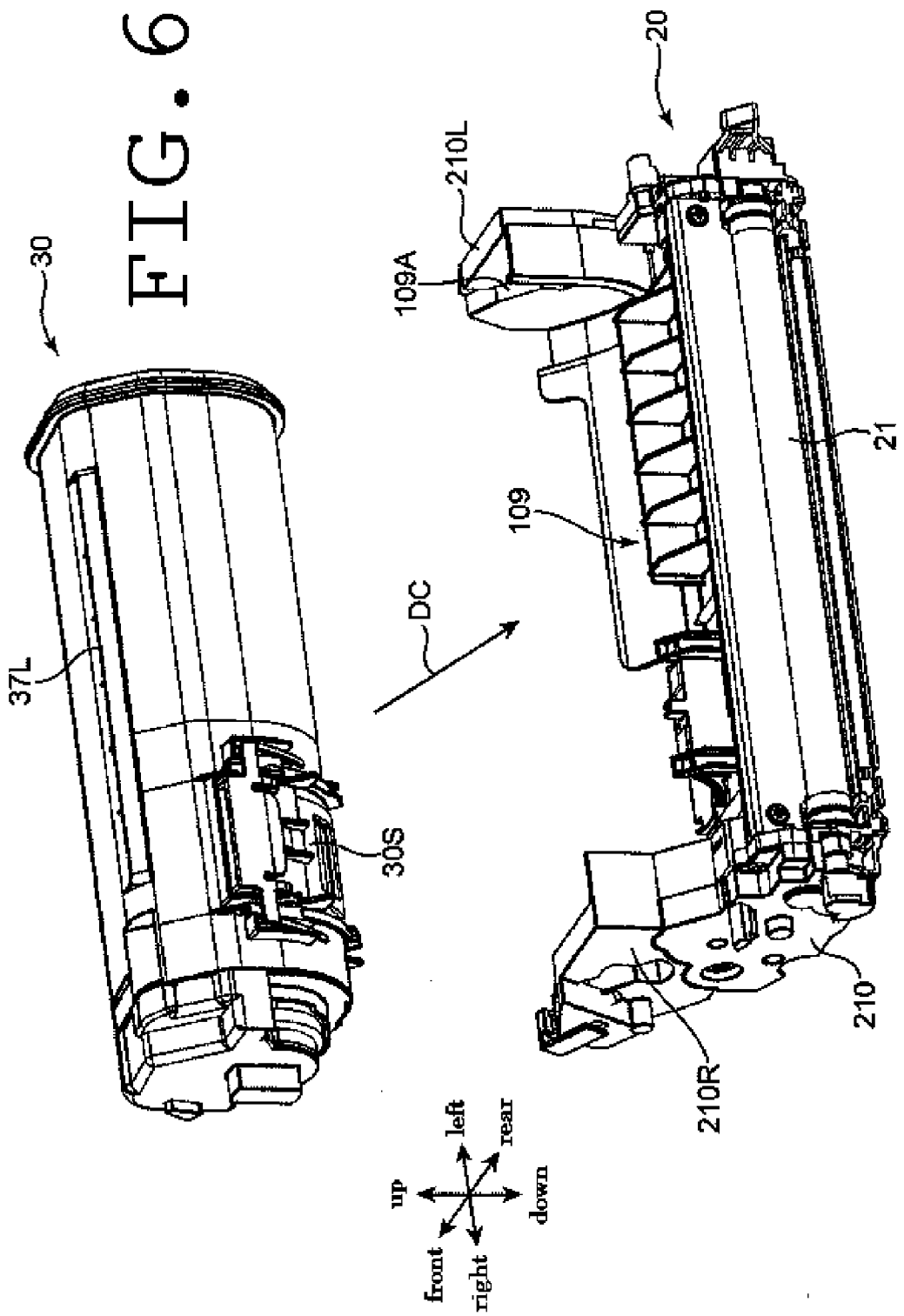
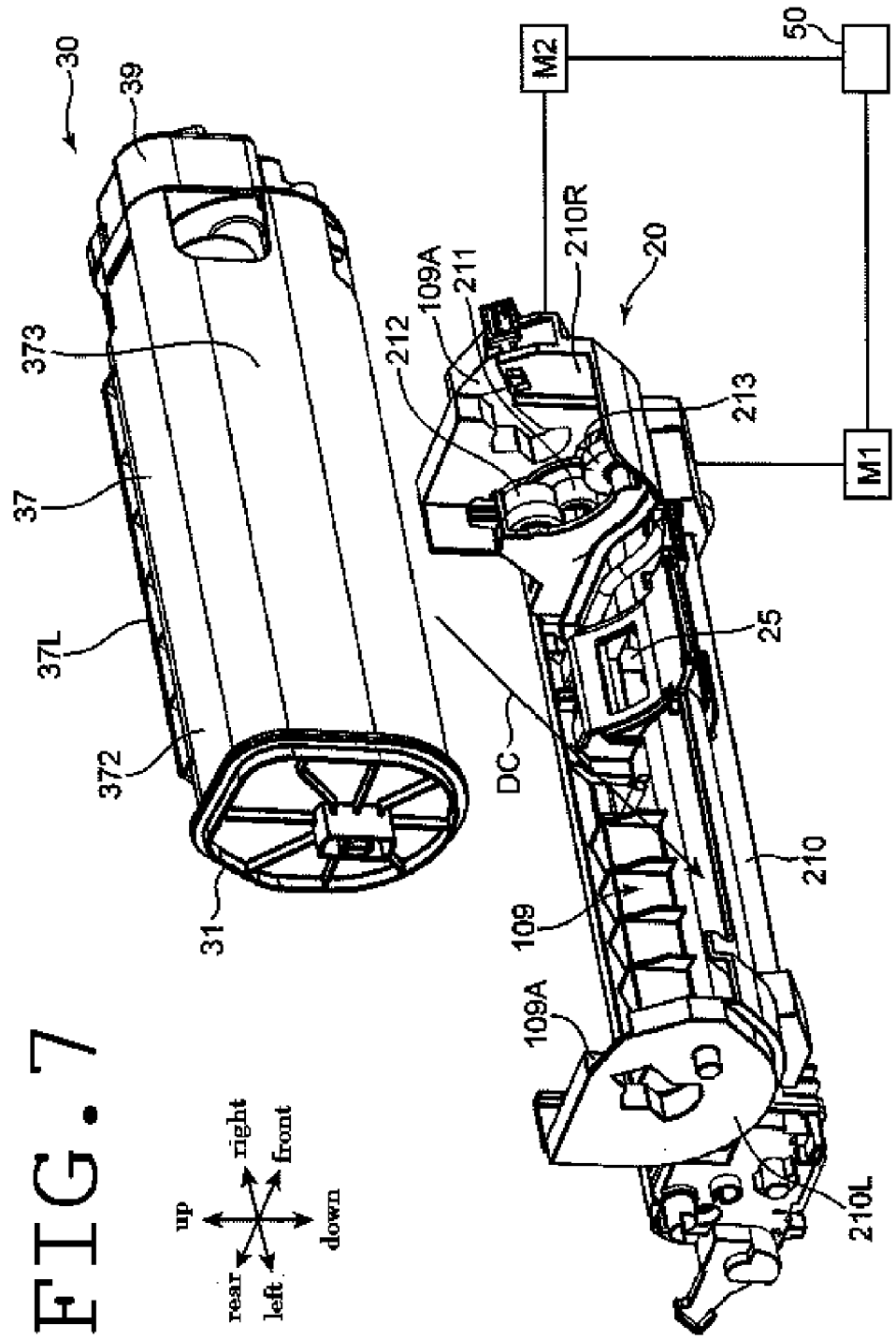

30
37L
30S
DC
20
210L
109A
109
21
210
210R
up
down
left
rear
front
right

FIG. 7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39
373
37
37L
372
31
M2
50
210R
20
109A
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212
213
M1
25
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210
109
109A
210L
up
right
front
down
rear
left

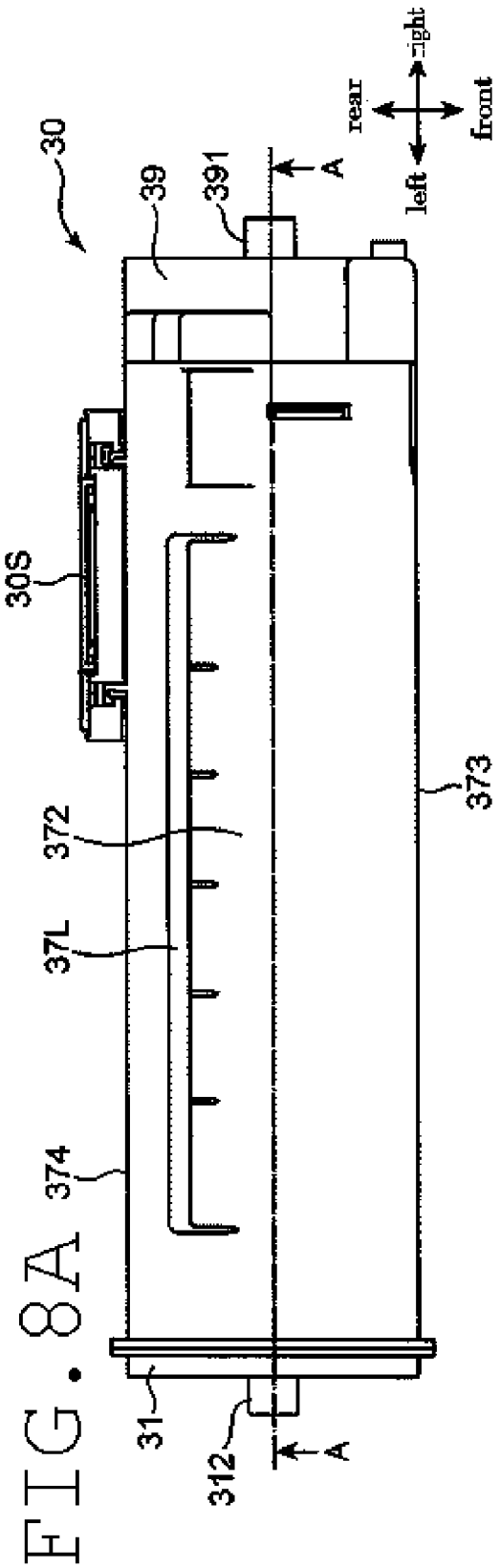


FIG. 8A

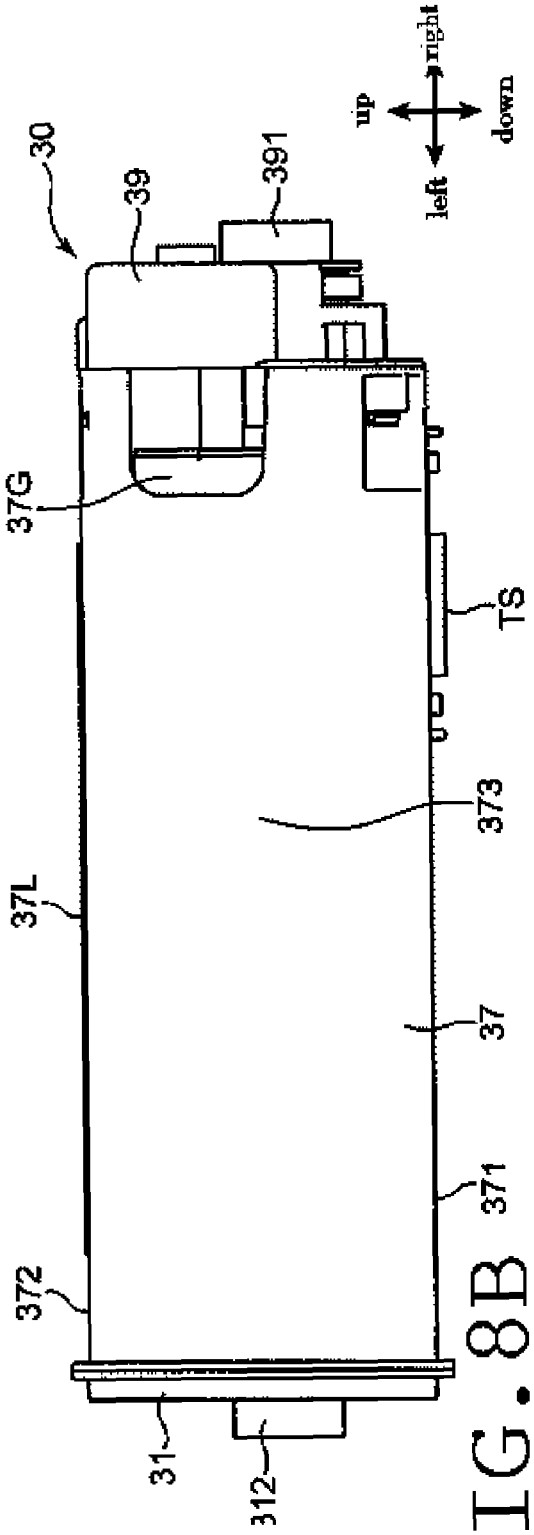
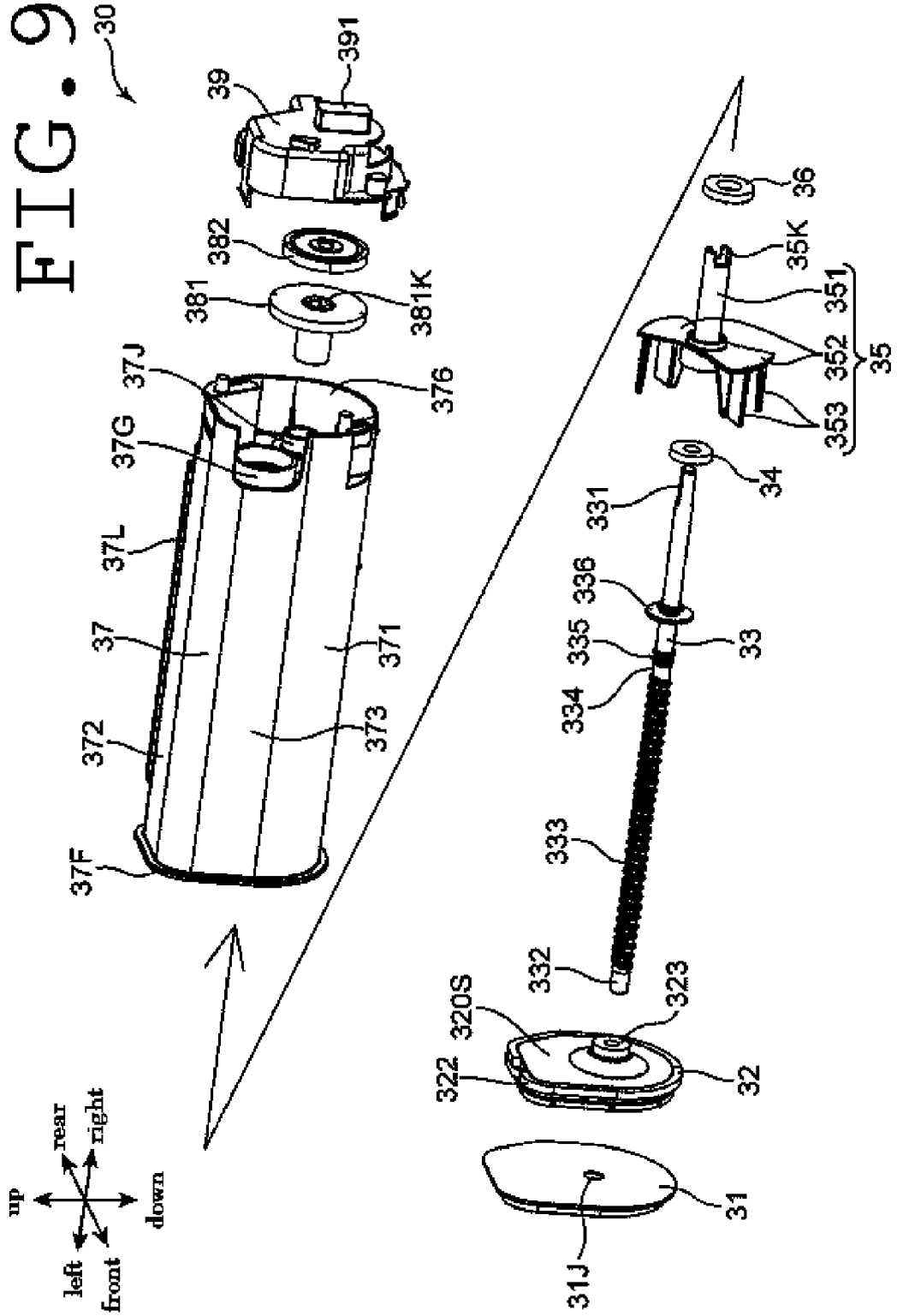


FIG. 8B

FIG. 9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39
391
382
381
381K
376
37J
37G
37L
37
371
373
372
37F
36
35K
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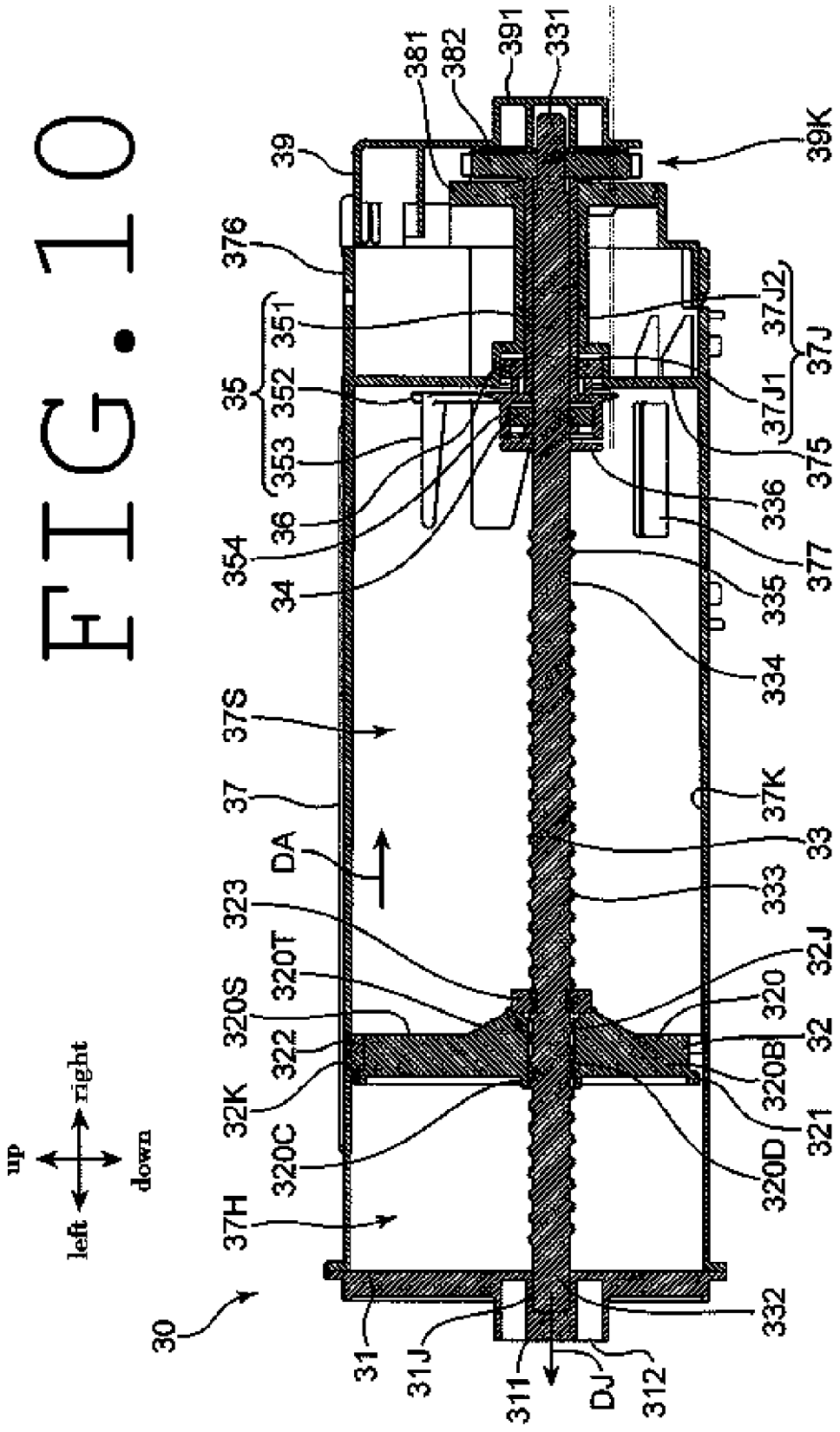
352
353
35
34
331
336
335
334
33
333
332
323
320S
322
32
31
31J
up
rear
right
down
left
front

FIG. 10


381
382
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351
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37J
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352
37J1
353
375
336
36
354
377
34
335
334
37S
37K
37
DA
33
323
333
320T
32J
320S
320
322
32
320B
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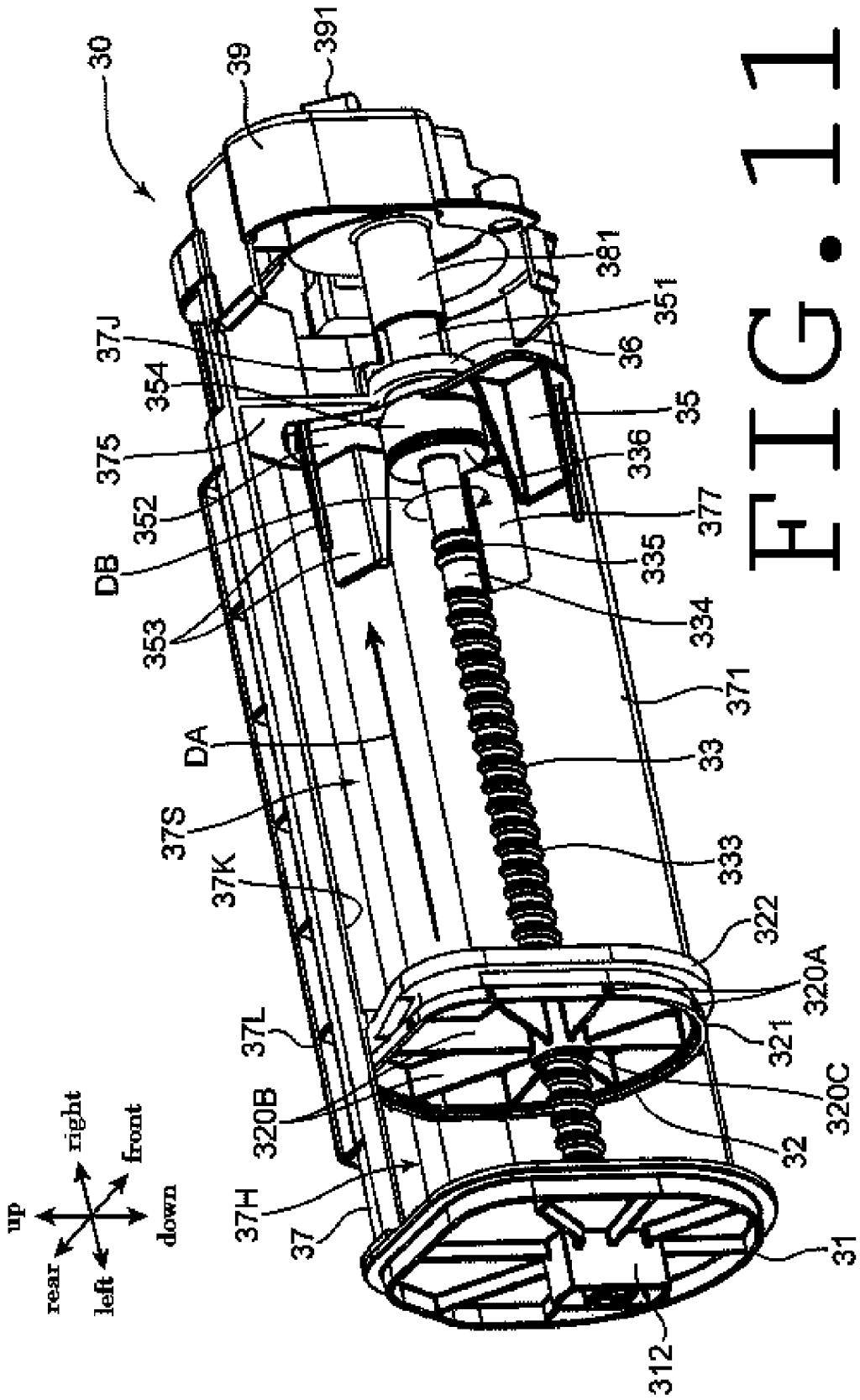
321
320C
320D
37H
30
332
31
31J
311
DJ
312
up
left
right
down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320C
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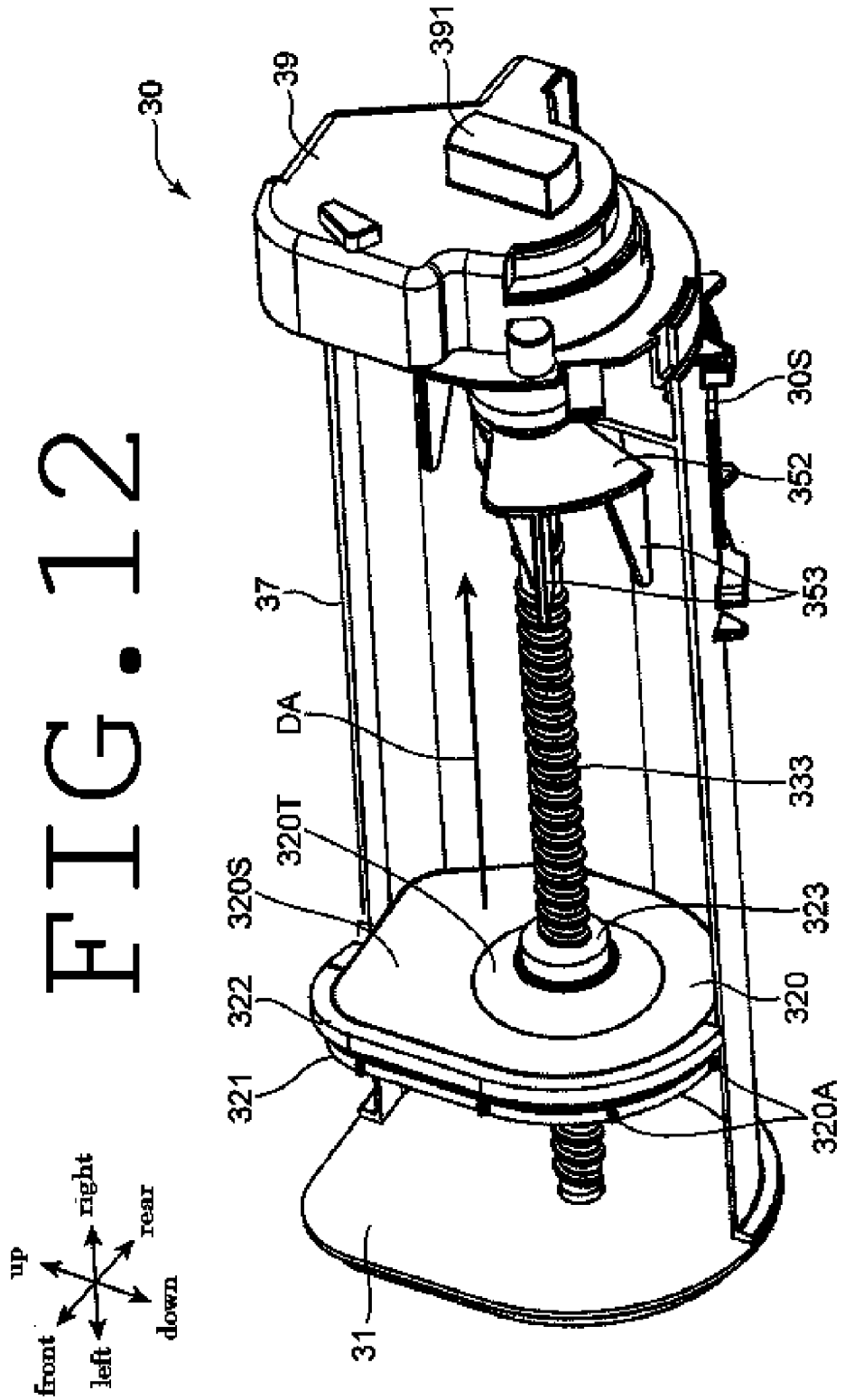
312
37J
354
375
352
DB
353
DA
37S
37K
37L
320B
37H
37
up
right
front
down
rear
left

FIG. 11

FIG. 12


30
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322
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321
320A
31
up
right
rear
front
left
down

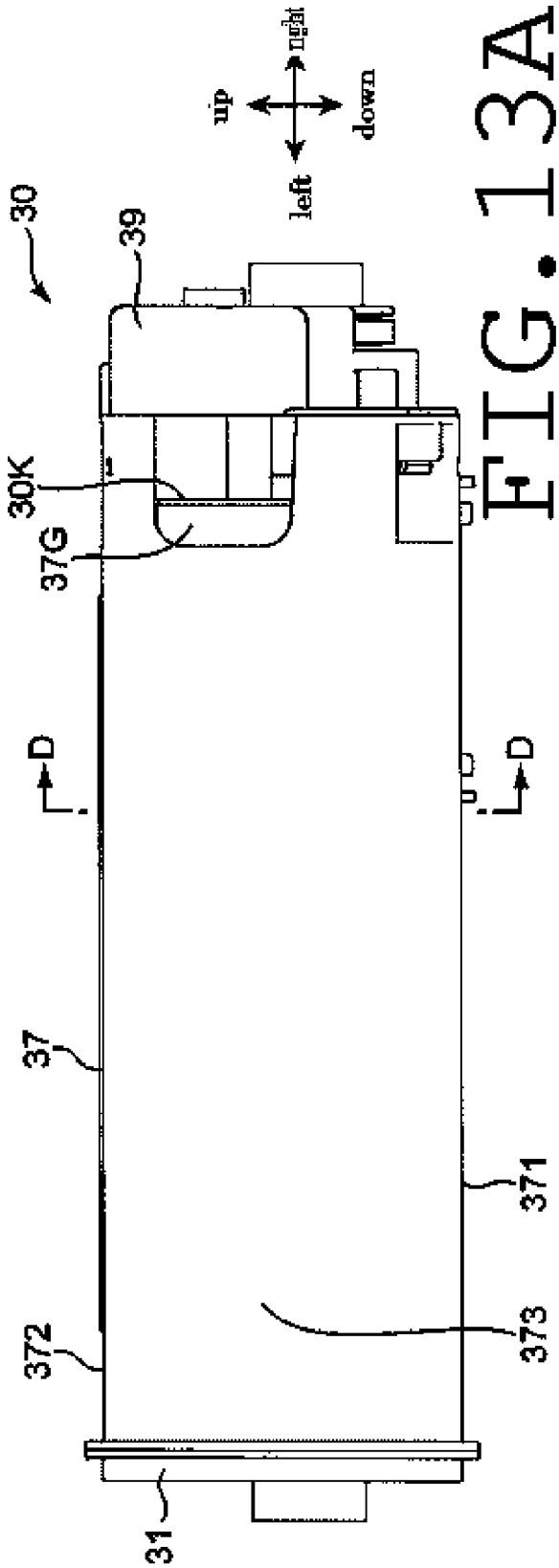
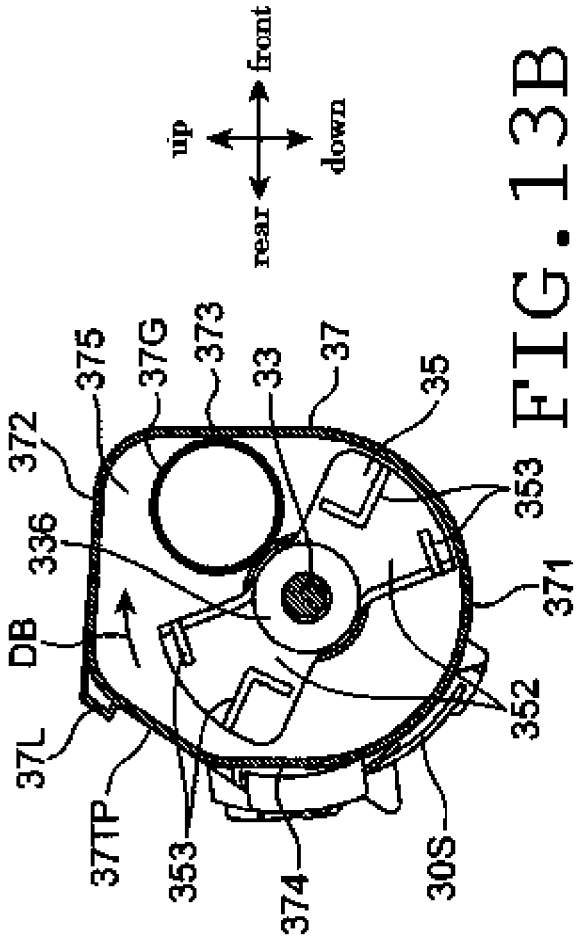


FIG. 13A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front
rear
down
372
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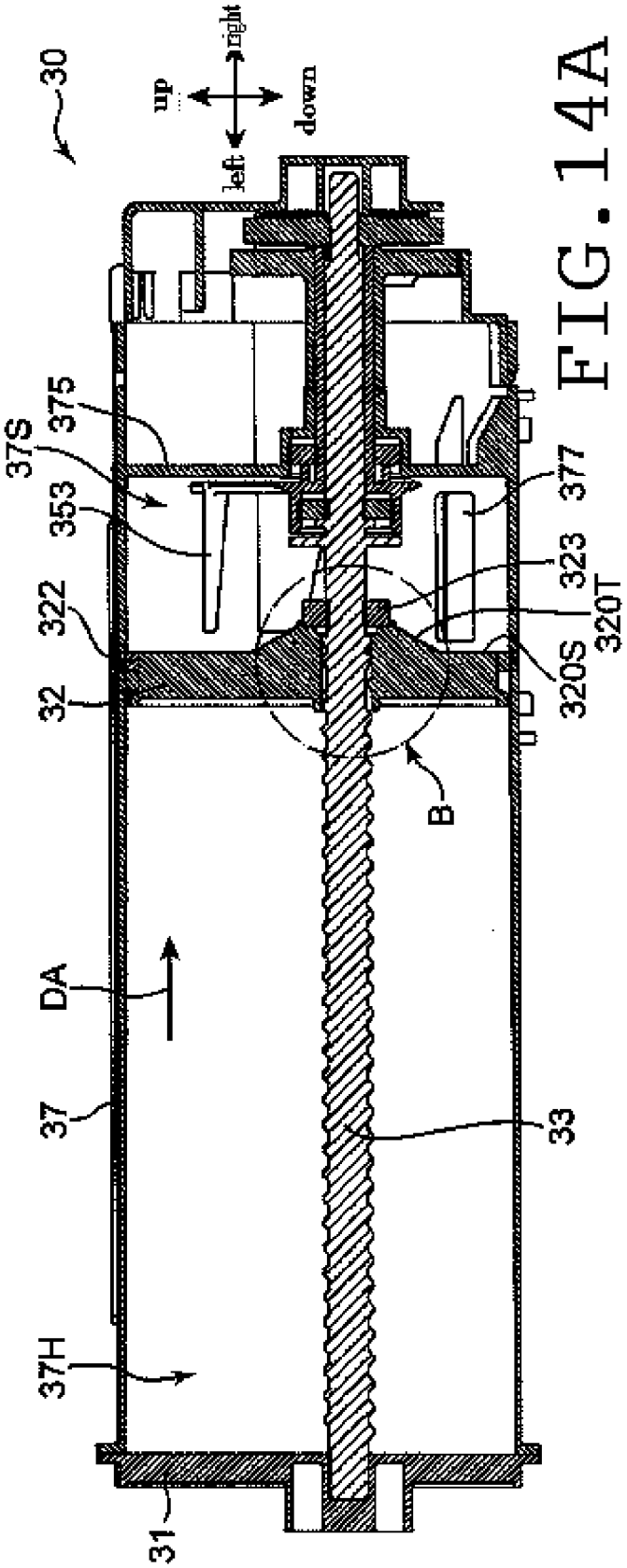
352
37L
37TP
353
374
30S

FIG. 13B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up
right
left
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37S
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31

FIG. 14A

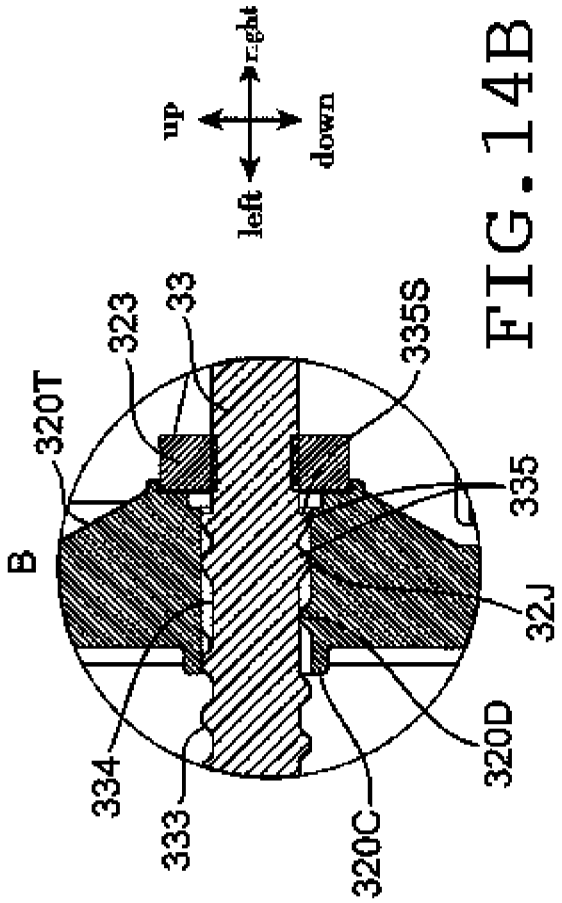
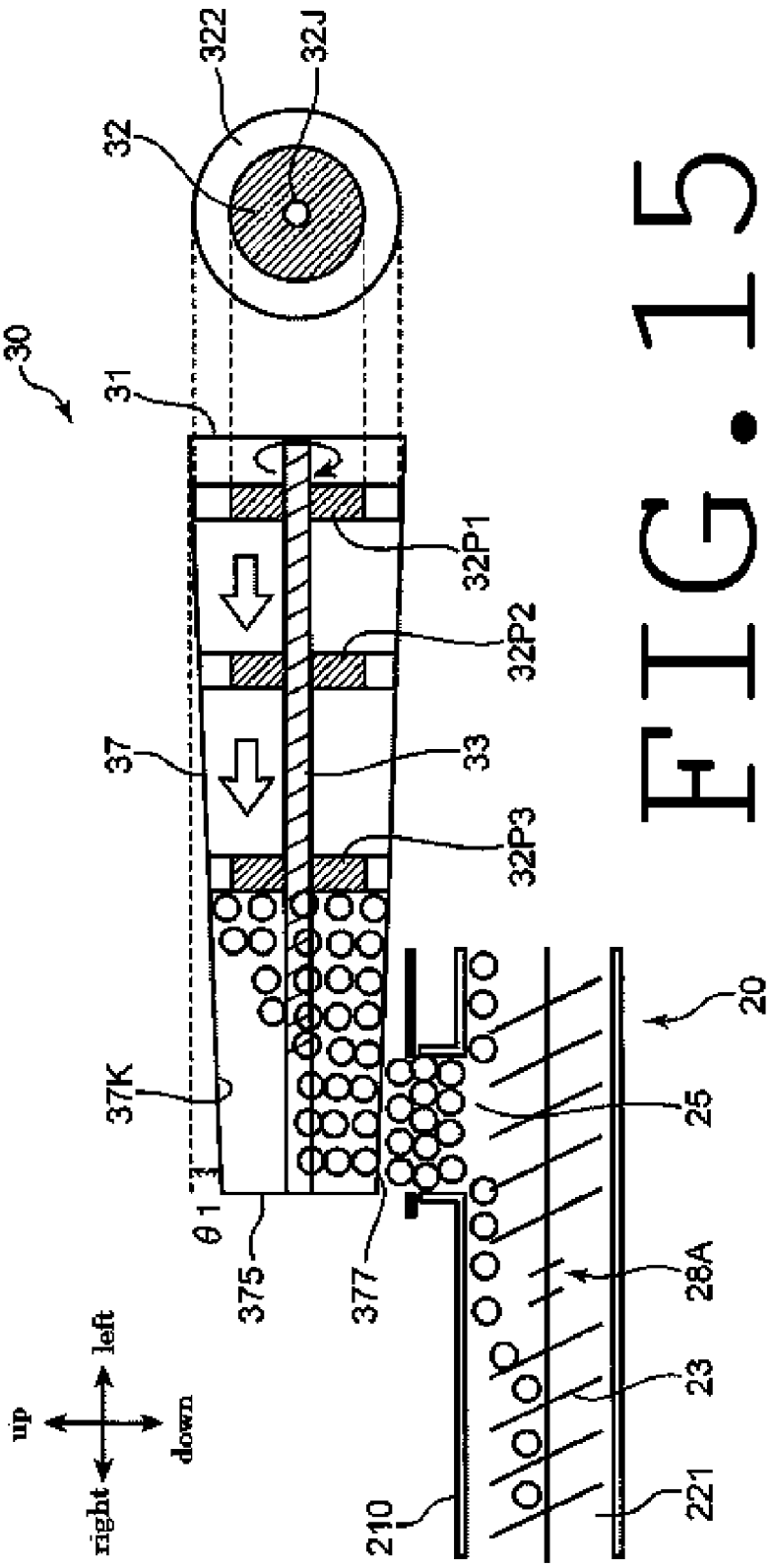


FIG. 14B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31
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32P2
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33
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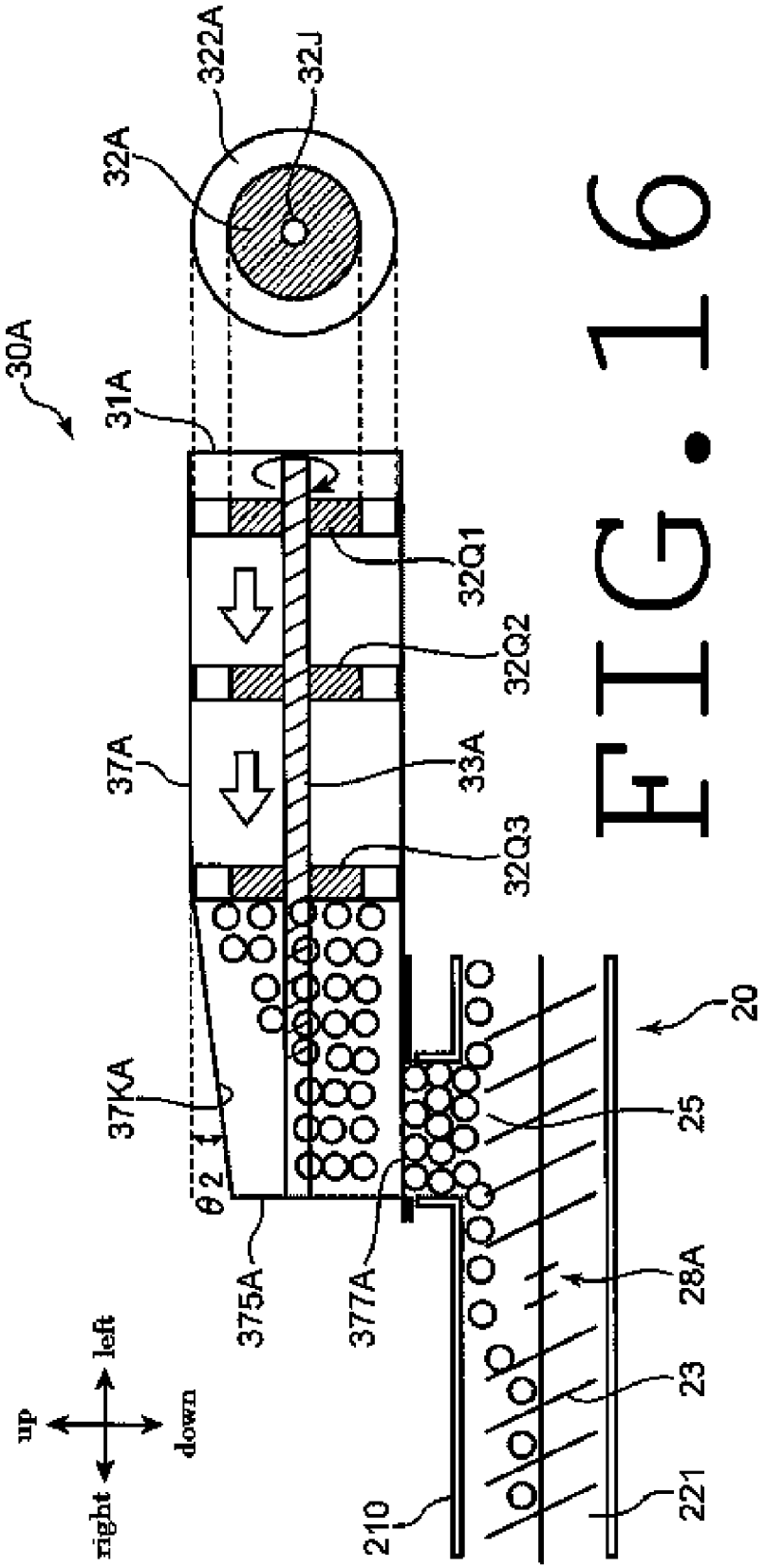
37K
25
θ1
375
377
28A
23
221
210
up
left
right
down

FIG. 15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32Q2
37A
33A
32Q3
20
37KA
θ2
25
28A
375A
377A
23
221
210
up
left
right
down

FIG. 16

DEVELOPER STORING CONTAINER, AND IMAGE FORMING APPARATUS PROVIDED WITH THE SAME

INCORPORATION BY REFERENCE

This application is based on and claims the benefit of priority from Japanese Patent Application No. 2014-172431 filed on Aug. 27, 2014, the contents of which are hereby incorporated by reference.

BACKGROUND

The present disclosure relates to a developer storing container that stores a developer, and an image forming apparatus provided with the same.

As a typical example of a developer storing container that stores a developer, that which is provided for an image forming apparatus is known. The image forming apparatus includes an image carrier, a developing apparatus, and a developer storing container. When the developer is supplied from the developing apparatus to the image carrier, an electrostatic latent image that is formed on the image carrier is actualized as a developer image. The developer storing container is provided with a developer discharge port, supplying a replenishing developer to a replenishing port that is provided in the developing apparatus.

A developer storing container has been disclosed which is provided with a moving wall that is moved while conveying the developer toward the developer discharge port.

SUMMARY

A developer storing container according to one aspect of the present disclosure is a developer storing container, including:

a container main body, being provided with an inner peripheral part, cylindrically extending along a first direction, and an internal space, being defined by the inner peripheral part,

a developer discharge port, being opened in a bottom face part of the container main body so as to be communicated with the inner peripheral part, and a developer being discharged therefrom,

a moving wall, being provided with an outer peripheral part, being disposed in tight contact with the inner peripheral part of the container main body, and a conveying face, defining a storing space together with the inner peripheral part of the container main body, the developer being stored therein; the moving wall being moved from an initial position on the one end side of said first direction to a final position on the other end side thereof in said internal space, while conveying said developer in said storing space toward said developer discharge port, and

a sealing member, forming the outer peripheral part of the moving wall, and being compressively deformed between the inner peripheral part of the container main body and the moving wall,

a cross-sectional area of the internal space of the container main body in a sectional view intersecting perpendicularly with the first direction being set so as to be decreased as the final position of the moving wall being approached.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view showing an image forming apparatus according to one embodiment of the present disclosure;

FIG. **2** is a perspective view showing the image forming apparatus according to one embodiment of the present disclosure in the state in which a part thereof is opened;

FIG. **3** is a schematic sectional view showing an internal construction of the image forming apparatus according to one embodiment of the present disclosure;

FIG. **4** is a schematic plan view showing an internal construction of a developing apparatus according to one embodiment of the present disclosure;

FIG. **5** is a schematic sectional view showing how a developer is replenished to the developing apparatus according to one embodiment of the present disclosure;

FIG. **6** is a perspective view of a developer storing container and the developing apparatus according to one embodiment of the present disclosure;

FIG. **7** is a perspective view of the developer storing container and the developing apparatus according to one embodiment of the present disclosure;

FIG. **8**A is a plan view of the developer storing container according to one embodiment of the present disclosure;

FIG. **8**B is a front view of the developer storing container according to one embodiment of the present disclosure;

FIG. **9** is an exploded perspective view of the developer storing container according to one embodiment of the present disclosure;

FIG. **10** is a sectional view of the developer storing container according to one embodiment of the present disclosure;

FIG. **11** is a perspective view showing how the inside of the developer storing container according to one embodiment of the present disclosure is constructed;

FIG. **12** is a perspective view showing how the inside of the developer storing container according to one embodiment of the present disclosure is constructed;

FIG. **13**A is a front view of the developer storing container according to one embodiment of the present disclosure;

FIG. **13**B is a sectional view of the developer storing container according to one embodiment of the present disclosure;

FIG. **14**A is a sectional view of the developer storing container according to one embodiment of the present disclosure;

FIG. **14**B is an enlarged sectional view of the developer storing container according to one embodiment of the present disclosure;

FIG. **15** is a schematic sectional view showing a tapered shape of an inner peripheral part of a container main body of the developer storing container according to one embodiment of the present disclosure; and

FIG. **16** is a schematic sectional view showing a tapered shape of an inner peripheral part of a container main body of the developer storing container according to one embodiment of the present disclosure.

DETAILED DESCRIPTION

Hereinbelow, referring to the drawings, one embodiment of the present disclosure will be explained. FIG. **1** and FIG. **2** are perspective views of a printer **100** (an image forming apparatus) according to one embodiment of the present disclosure. FIG. **3** is a sectional view schematically showing an internal construction of the printer **100** shown in FIG. **1** and FIG. **2**. The printer **100** shown in FIG. **1** to FIG. **3** as an image forming apparatus is a so-called monochrome printer. However, in another embodiment, the image forming apparatus may be a color printer, a facsimile apparatus, a Multifunctional Peripheral (MFP) equipped with such functions, or other apparatus for forming a toner image on a sheet. The term that is used in the following explanation to express a direction, such as "up" or "down", "front" or "rear", or "right" or

"left", is used simply for clarification of the explanation, and will not make any limitation of the principle of the image forming apparatus.

The printer **100** is provided with a casing **101** that houses various apparatuses for forming an image on a sheet S. The casing **101** includes a top wall **102**, which defines a top face of the casing **101**, and a bottom wall **103**, which defines a bottom face of the casing **101** (FIG. **3**); a main body rear wall **105** between the top wall **102** and the bottom wall **103** (FIG. **3**); and a main body front wall **104**, which is located in front of the main body rear wall **105**. The casing **101** is provided with a main body internal space **107**, in which various apparatuses are disposed. In the main body internal space **107** in the casing **101**, there is extendedly provided a sheet carrying passage PP, with which the sheet S is conveyed in a specific conveying direction. In addition, the printer **100** is provided with an opening/closing cover **100**C, which is openably loaded onto the casing **101**.

The opening/closing cover **100**C is composed of a front wall upper part **104**B, which is an upper portion of the main body front wall **104**, and a top wall front part **102**B, which is a front portion of the top wall **102**. In addition, the opening/closing cover **100**C can be opened and closed in a vertical direction with a hinge shaft (not shown) as a fulcrum, which is disposed in a pair of arm parts **108**, which are provided in both end parts in a lateral direction (FIG. **2**). In the open state of the opening/closing cover **100**C, the top of the main body internal space **107** is opened to the outside. On the other hand, in the closed state of the opening/closing cover **100**C, the top of the main body internal space **107** is closed.

In the central part of the top wall **102**, a paper delivery part **102**A is disposed. The paper delivery part **102**A is formed of an inclination surface, which is inclined downward from the front portion of the top wall **102** to the rear portion thereof. To the paper delivery part **102**A, the sheet S, on which an image is formed in a below-mentioned image forming part **120**, is discharged. In addition, in the central part in a vertical direction of the main body front wall **104**, a manual feed tray **104**A is disposed. The manual feed tray **104**A can be vertically turned with the lower end as a fulcrum (in a direction of arrow DT in FIG. **3**).

Referring to FIG. **3**, the printer **100** includes a cassette **110**, a pickup roller **112**, a first feed roller **113**, a second feed roller **114**, a conveyance roller **115**, a registration roller pair **116**, an image forming part **120**, and a fixing apparatus **130**.

The cassette **110** stores a sheet S in the inside thereof. The cassette **110** is provided with a lifting plate **111**. The lifting plate **111** is inclined so as to push up the leading edge of the sheet S. The cassette **110** can be drawn forward with respect to the casing **101**.

The pickup roller **112** is disposed on the leading edge of the sheet S, which has been pushed up by the lifting plate **111**. When the pickup roller **112** is rotated, the sheet S is pulled out from the cassette **110**.

The first feed roller **113** is disposed downstream of the pickup roller **112**, feeding out the sheet S further downstream. The second feed roller **114** is disposed inside of the fulcrum of the manual feed tray **104**A (behind it), pulling in the sheet S on the manual feed tray **104**A into the casing **101**.

The conveyance roller **115** is disposed downstream in the sheet conveying direction (which, hereinbelow, may be simply referred to as the conveying direction) of the first feed roller **113** and the second feed roller **114** (which, hereinbelow, may be simply referred to as downstream). The conveyance rollers **115** conveys further downstream the sheet S that has been fed out by the first feed roller **113** and the second feed roller **114**.

The registration roller pair **116** has a function to correct an oblique conveyance of the sheet S. Thereby, the position of an image that is formed on the sheet S is correctly adjusted. The registration roller pair **116** supplies the sheet S to the image forming part **120** in accordance with the timing of image formation made by the image forming part **120**.

The image forming part **120** includes a photosensitive drum **121** (an image carrier), an electrifier **122**, an exposure apparatus **123**, a developing apparatus **20**, a toner container **30** (a developer storing container), a transfer roller **126** (a transfer part), and a cleaning apparatus **127**.

The photosensitive drum **121** has a cylindrical shape. The photosensitive drum **121** has a surface on which an electrostatic latent image is formed, and carries a toner image (a developer image) in accordance with the electrostatic latent image on the surface. The electrifier **122**, to which a specific voltage is applied, electrifies substantially uniformly the circumferential surface of the photosensitive drum **121**.

The exposure apparatus **123** irradiates a laser beam onto the circumferential surface of the photosensitive drum **121**, which has been electrified by the electrifier **122**. The laser beam is irradiated in accordance with image data that has been outputted from an external apparatus (not shown), such as a personal computer, that is communicably connected to the printer **100**. As a result of this, an electrostatic latent image corresponding to the image data is formed on the circumferential surface of the photosensitive drum **121**.

The developing apparatus **20** supplies toner to the circumferential surface of the photosensitive drum **121**, on which the electrostatic latent image has been formed. The toner container **30** supplies the toner (a replenishing developer) to the developing apparatus **20**. The toner container **30** is detachably disposed on the developing apparatus **20**. When the developing apparatus **20** supplies the toner to the photosensitive drum **121**, the electrostatic latent image that has been formed on the circumferential surface of the photosensitive drum **121** is developed (visualized). As a result of this, a toner image (a developer image) is formed on the circumferential surface of the photosensitive drum **121**.

The transfer roller **126** is disposed under the photosensitive drum **121**, being opposed thereto with the sheet carrying passage PP being sandwiched between both. The transfer roller **126** forms a transfer nip part between it and the photosensitive drum **121** to transfer the toner image onto the sheet S.

The cleaning apparatus **127** removes the toner remaining on the circumferential surface of the photosensitive drum **121** after the toner image having been transferred onto the sheet S.

The fixing apparatus **130** is disposed on the downstream side of the image forming part **120** in the conveying direction to fix the toner image on the sheet S. The fixing apparatus **130** includes a heating roller **131**, which fuses the toner on the sheet S, and a pressure roller **132**, which causes the sheet S to be tightly contacted with the heating roller **131**.

The printer **100** further includes a conveyance roller pair **133**, which is disposed downstream of the fixing apparatus **130**, and a discharge roller pair **134**, which is disposed downstream of the conveyance roller pair **133**. The sheet S is conveyed upward by the conveyance roller pair **133**, and finally discharged from the casing **101** by the discharge roller pair **134**. The sheet S, which has been discharged from the casing **101**, is stacked on the paper delivery part **102**A.

<About Developing Apparatus>

FIG. **4** is a plan view showing an internal construction of the developing apparatus **20**. The developing apparatus **20** is provided with a developing housing **210** (a housing), which has a box shape long in one direction (the axial direction or a

lateral direction of a developing roller **21**). The developing housing **210** has a storing space **220** (a developer carrying passage). In the storing space **220**, the developing roller **21**, a first stirring screw **23** (a developer conveying member) and a second stirring screw **24**, and a toner replenishing port **25** are disposed. In the present embodiment, the one-component development system is applied, and this storing space **220** is filled with toner as a developer. On the other hand, in the case of the two-component development system, a mixture of the toner and a carrier comprised of a magnetic substance is filled in as a developer. The toner is stirred and conveyed in the storing space **220**, being successively supplied to the photosensitive drum **121** from the developing roller **21** to develop the electrostatic latent image.

The developing roller **21** has a cylindrical shape that is extendedly provided in a longitudinal direction of the developing housing **210**, and, on the outer periphery, has a sleeve portion which is rotationally driven. The storing space **220** of the developing housing **210** is covered with a top plate (not shown), and is partitioned into a first carrying passage **221** and a second carrying passage **222**, which are long in a lateral direction, by a partitioning plate **22**, which is extended in a lateral direction. The partitioning plate **22** is shorter than the length in the lateral direction of the developing housing **210**. At the left end and the right end of the partitioning plate **22**, there are provided a first communicating passage **223** and a second communicating passage **224**, which respectively communicate between the first carrying passage **221** and the second carrying passage **222**. Thereby, in the storing space **220**, there is formed a circulation path from the first carrying passage **221** to the first communicating passage **223** through the second communicating passage **224** and the second carrying passage **222**. The toner is conveyed in the circulation path in a counterclockwise direction in FIG. **4**.

The toner replenishing port **25** (the developer replenishing port) is an opening part, which is opened in the top plate of the developing housing **210**, and is located upward in the vicinity of the left end of the first carrying passage **221**. The toner replenishing port **25** is disposed, being opposed to the above-mentioned circulation path. The toner replenishing port **25** has a function to receive the replenishing toner (the replenishing developer), which is replenished from the toner discharge port **377** of the toner container **30** (FIG. **4**) into the storing space **220**.

The first stirring screw **23** is disposed in the first carrying passage **221**. The first stirring screw **23** includes a first rotating shaft **23***a*, and a first spiral blade **23***b*, which is provided protrusively in a spiral shape on the circumference of the first rotating shaft **23***a*. The first stirring screw **23** is rotationally driven around the first rotating shaft **23***a* (in a direction of arrow R**2**), thereby conveying the toner in a direction of arrow D**1** in FIG. **4**. The first stirring screw **23** conveys the developer such that it passes the location where the toner replenishing port **25** is opposed to the first carrying passage **221**. Thus, the first stirring screw **23** has a function of conveyance while mixing fresh toner flowing from the toner replenishing port **25** with the toner that has been conveyed from the side of the second carrying passage **222** into the first carrying passage **221**. On the downstream side of the first stirring screw **23** in the toner conveying direction (the direction of D**1**), a first paddle **23***c* is disposed. The first paddle **23***c* is a plate-like member that is disposed on the first rotating shaft **23***a*. The first paddle **23***c* is rotated together with the first rotating shaft **23***a*, and passes the toner from the first carrying passage **221** to the second carrying passage **222** in a direction of arrow D**4** in FIG. **4**.

The second stirring screw **24** is disposed in the second carrying passage **222**. The second stirring screw **24** includes a second rotating shaft **24***a*, and a second spiral blade **24***b*, which is provided protrusively in a spiral shape on the circumference of the second rotating shaft **24***a*. The second stirring screw **24** is rotationally driven around the second rotating shaft **24***a* (in a direction of arrow R**1**) to convey the toner in a direction of arrow D**2** in FIG. **4**, thereby supplying the toner to the developing roller **21**. On the downstream side of the second stirring screw **24** in the toner conveying direction (the direction of D**2**), a second paddle **24***c* is disposed. The second paddle **24***c* is rotated together with the second rotating shaft **24***a*, and passes the toner from the second carrying passage **222** to the first carrying passage **221** in a direction of arrow D**3** in FIG. **4**.

The toner container **30** (FIG. **3**) is disposed above the toner replenishing port **25** of the developing housing **210**. The toner container **30** is provided with the toner discharge port **377** (FIG. **4**). The toner discharge port **377** is disposed in a bottom part **371** (FIG. **8**B) of the toner container **30** in correspondence to the toner replenishing port **25** in the developing apparatus **20**. The toner that has been dropped from the toner discharge port **377** is replenished to the developing apparatus **20** from the toner replenishing port **25**.

<About Toner Replenishment>

Next, the flow of the toner newly replenished from the toner replenishing port **25** will be explained. FIG. **5** is a sectional view of an area in the vicinity of the toner replenishing port **25**, which is disposed in the developing apparatus **20**, and the toner discharge port **377**, which is disposed in the toner container **30**.

The replenished toner T**2**, which has been supplied from the toner discharge port **377** of the toner container **30**, is dropped into the first carrying passage **221** to be mixed with the existing toner T**1**, and is conveyed in the direction of arrow D**1** by the first stirring screw **23**. At this time, the toners T**1** and T**2** are stirred, and electrified.

The first stirring screw **23** is provided with a suppressing paddle **28** (a conveying capacity suppressing part), with which the performance of developer conveyance is partially suppressed, on the downstream side of the toner replenishing port **25** in the toner conveying direction. In the present embodiment, the suppressing paddle **28** is a plate-like member that is disposed between first spiral blades **23***b* of the first stirring screw **23** that are adjacent to each other. With the suppressing paddle **28** being rotated around the first rotating shaft **23***a*, the toner that is conveyed from the upstream side of the suppressing paddle **28** starts to be retained. Then, such toner retentions are accumulated to a location that is just on the upstream side of the suppressing paddle **28**, and where the toner replenishing port **25** is opposed to the first carrying passage **221**. As a result of this, in the vicinity of the mouth of the toner replenishing port **25**, a retaining part **29** for developer (a developer retaining part) is formed. In the region where the toner replenishing port **25** is provided, the first spiral blade **23***b* is disposed (FIG. **4**). In addition, in another embodiment, the conveying capacity suppressing part may be formed by providing a region where the first spiral blade **23***b* of the first stirring screw **23** is partially omitted, and thus the first rotating shaft **23***a* is partially exposed along the axial direction. With such a configuration, the conveying capacity of the first stirring screw **23** is partially suppressed, thereby a developer retaining part being formed.

If the replenishing toner T**2** is replenished from the toner replenishing port **25**, thereby the quantity of the toner in the storing space **220** being increased, the toner retaining in this retaining part **29** blocks (seals) the toner replenishing port **25**

for suppressing further replenishment of the toner. In addition, the first spiral blade **23***b* is rotated to thereby push up the developer in the storing space **220** around the toner replenishing port **25**. As a result of this, the sealing action of the toner replenishing port **25** due to the retaining part **29** is increased. Thereafter, if the toner in the storing space **220** is consumed from the developing roller **21**, the quantity of the toner retaining in the retaining part **29** being decreased, the quantity of the toner that has blocked the toner replenishing port **25** is decreased, thereby a clearance being produced between the retaining part **29** and the toner replenishing port **25**. As a result of this, the replenishing toner T**2** is caused to again flow into the storing space **220** from the toner replenishing port **25**. Thus, in the present embodiment, there has been adopted the toner replenishing form of volume replenishment type with which the quantity of the replenishing toner received is properly adjusted as the quantity of the toner retaining in the retaining part **29** is decreased. Therefore, without providing any sensor for detecting the quantity of toner in the developing housing **210** of the developing apparatus **20**, it is possible to replenish a proper quantity of toner to the developing apparatus **20**.

<About Loading of Toner Container onto Developing Apparatus>

FIG. **6** and FIG. **7** are perspective views of the toner container **30** and the developing apparatus **20** according to the present embodiment. The toner container **30** can be loaded onto and removed from the developing apparatus **20** in the casing **101**. Referring to FIG. **2**, when the opening/closing cover **100**C of the casing **101** is opened upward, a container accommodating part **109**, which is provided in the developing housing **210** of the developing apparatus **20**, is exposed to the outside of the casing **101**. Referring to FIG. **6** and FIG. **7**, the developing housing **210** is provided with a pair of a housing left wall **210**L and a housing right wall **210**R. The container accommodating part **109** is formed between the housing left wall **210**L and the housing right wall **210**R. In the present embodiment, the toner container **30** is loaded onto the container accommodating part **109** substantially from above (see arrow DC in FIG. **6** and FIG. **7**). At this time, a below-mentioned cover **39** of the toner container **30** is located on the side of the housing right wall **210**R, while a below-mentioned lid part **31** of the toner container **30** is located on the side of the housing left wall **210**L. The developing housing **210** is provided with a pair of guide grooves **109**A (FIG. **7**). The guide grooves **109**A are groove portions that are formed in the housing left wall **210**L and the housing right wall **210**R.

Further, referring to FIG. **7**, the developing apparatus **20** is provided with a first transmission gear **211**, a second transmission gear **212**, and a third transmission gear **213**. In addition, the printer **100** is provided with a first motor M**1**, a second motor M**2**, and a control part **500**, which are provided in the casing **101**. The first transmission gear **211**, the second transmission gear **212**, and the third transmission gear **213** are gears that are rotatably supported by the housing right wall **210**R. The first transmission gear **211** is connected to the second transmission gear **212**. In addition, the first transmission gear **211** is connected to the developing roller **21**, the first stirring screw **23**, and the second stirring screw **24** through a group of gears (not shown). When the developing apparatus **20** is loaded in the casing **101**, the first motor M**1** is connected to the third transmission gear **213**, and the second motor M**2** is connected to the first transmission gear **211**.

The first motor M**1** rotates a below-mentioned shaft **33** of the toner container **30** through the third transmission gear **213**, thereby moving a below-mentioned moving wall **32** of the toner container **30**. In the present embodiment, the first motor M**1** is capable of being forwardly and reversely rotated. The second motor M**2** rotates the developing roller **21**, the first stirring screw **23**, and the second stirring screw **24** of the developing apparatus **20** through the first transmission gear **211**. Further, the second motor M**2** rotates a below-mentioned stirring member **35** of the toner container **30** through the first transmission gear **211** and the second transmission gear **212**. The control part **500** controls the first motor M**1** and the second motor M**2**, respectively, in the printing operation, or the like, of the printer **100**, driving the respective members of the developing apparatus **20** and the toner container **30**.

<About Construction of Toner Container>

Next, referring to FIG. **8** to FIG. **14**, the toner container **30** (the developer storing container) according to one embodiment of the present disclosure will be explained. FIG. **8**A is a plan view of the toner container **30** according to the present embodiment. FIG. **8**B is a front view of the toner container **30** according to the present embodiment. FIG. **9** is an exploded perspective view of the toner container **30**. FIG. **10** is a sectional view of the toner container **30**. FIG. **11** and FIG. **12** are perspective views showing how the inside of the toner container **30** according to the present embodiment is constructed. FIG. **11** and FIG. **12** are perspective views in which a below-mentioned container main body **37** of the toner container **30** is partially omitted. FIG. **13**A is a front view of the toner container **30** according to the present embodiment. FIG. **13**B is a sectional view of the toner container **30** according to the present embodiment. FIG. **14**A is a sectional view of the toner container **30** according to the present embodiment. FIG. **14**B is an enlarged sectional view of the toner container **30** according to the present embodiment.

The toner container **30** is formed in a cylindrical shape that extends in a lateral direction (a first direction, i.e., a direction of arrow DA in FIG. **10**). The toner container **30** stores the replenishing toner (the developer) in the inside thereof. Referring to FIG. **9**, the toner container **30** includes a lid part **31**, a moving wall **32**, a shaft **33**, a first seal **34**, a stirring member **35**, a second seal **36**, a container main body **37** (a container main body), a filling port cap **30**K (FIG. **13**A), a toner sensor TS (FIG. **8**B), a first gear **381** (FIG. **9**), a second gear **382**, and a cover **39**.

The lid part **31** (FIG. **9** and FIG. **10**) is fixed to the container main body **37**, sealing an opening part of the container main body **37**. The lid part **31** is provided with a lid shaft hole part **31**J, an abutting part **311**, and a first guide part **312**. The lid shaft hole part **31**J is provided in the central part of the lid part **31**, pivotally supporting the shaft **33** in a rotatable manner. The lid shaft hole part **31**J is a hole part that is formed over a specific length in a leftward direction from a side face on the right side (an inner face part) of the lid part **31**. The abutting part **311** corresponds to a bottom face part of the lid shaft hole part **31**J. Against the abutting part **311**, an end face of the shaft **33** is abutted. The first guide part **312** (FIG. **11**) is a protruding part that is formed so as to extend in a vertical direction on a side face on the left side (an outer face part) of the lid part **31**. The first guide part **312** has a function to guide the toner container **30** to be loaded onto the developing apparatus **20**.

The container main body **37** is a main body portion of the toner container **30**, being formed in a cylindrical shape. The container main body **37** is provided with an inner peripheral part **37**K and an internal space **37**H (FIG. **10** and FIG. **11**). The inner peripheral part **37**K is an inner peripheral face of the container main body **37**, cylindrically extending along a longitudinal direction of the toner container **30** (a first direction, i.e., a direction of arrow DA in FIG. **10** and FIG. **11**).

In addition, referring to FIG. **8**A and FIG. **8**B, the container main body **37** is provided with a bottom part **371**, a top plate

372, a front wall 373, a rear wall 374, a right wall 375 (FIG. 10) (a wall part), a main body flange part 37F (FIG. 9), and a protruding wall 376 (FIG. 9 and FIG. 10). The bottom part 371 is a bottom portion of the container main body 37, being formed in a semi-cylindrical shape protruding toward downward. In other words, when viewed from the section crossing with the first direction, the bottom part 371 is formed in a circular arc shape. The front wall 373 and the rear wall 374 are a pair of side walls that are erected toward upward from the side ends of the bottom part 371. The top plate 372 is disposed above the bottom part 371, covering the top of the internal space 37H. The right wall 375 is a wall part that blocks the container main body 37, being provided jointly with the other end side of the first direction (the right end side) of the bottom part 371, the front wall 373, the rear wall 374 and the top plate 372. The internal space 37H is a space that is defined by the inner peripheral part 37K, which is formed by the bottom part 371, the top plate 372, the front wall 373, and the rear wall 374, and further the right wall 375 and the lid part 31. In addition, in the internal space 37H, the region between the right wall 375 and the moving wall 32 provides a storing space 37S. The storing space 37S is a space in which the toner is stored in the inside of the toner container 30. As described below, the inner peripheral part 37K is slightly tapered along the first direction such that the cross-sectional area of the internal space 37H in the container main body 37 is decreased along the first direction (FIG. 15).

As shown in FIG. 10, the container main body 37 is opened on the opposite side of the first direction of the right wall 375. The main body flange part 37F is a portion that forms the opening part, having an outside diameter slightly larger than that of the left end part of the container main body 37. When the lid part 31 is fixed to the main body flange part 37F, the lid part 31 blocks the internal space 37H of the container main body 37. The outer peripheral edge of the lid part 31 is ultrasonic-welded to the main body flange part 37F.

Referring to FIG. 9 and FIG. 10, the protruding wall 376 is a portion where the outer peripheral part of the container main body 37 is protruded to the right side from the right wall 375. Onto the protruding wall 376, the cover 39 is loaded.

In addition, the container main body 37 is provided with the toner discharge port 377 (the developer discharge port), a shutter 30S, a holding part 37L, a filling port 37G, and a main body bearing part 37J. The toner discharge port 377 is an opening that is opened in a bottom face part of the container main body 37, being communicated with the inner peripheral part 37K. As shown in FIG. 10 and FIG. 11, the toner discharge port 377 is opened in a right end part (the first direction other end part) of the container main body 37. In other words, the toner discharge port 377 is disposed adjacent to the right wall 375 in the first direction. In addition, the toner discharge port 377 is opened in a rectangular shape, having a specific length along the first direction, and having a specific width along the circular arc shape of the bottom part 371. In the present embodiment, the toner discharge port 377 is opened in a location that is displaced to the rear side and upward along a circumferential direction from the lower end part of the bottom part 371.

The toner that has been stored in the storing space 37S is discharged from the toner discharge port 377 toward the developing apparatus 20. As described above, in the present embodiment, the internal space 37H of the container main body 37 is formed by the bottom part 371, the front wall 373, the rear wall 374, and the top plate 372. Therefore, the toner in the storing space 37S is collected by its own weight into the bottom part 371, which is formed in a circular arc shape, whereby the toner that is conveyed by the below-mentioned moving wall 32 can be efficiently discharged from the toner discharge port 377.

The shutter 30S (FIG. 6) is slidably disposed in the right end part of the container main body 37. The shutter 30S blocks (seals) the toner discharge port 377 from the outside of the container main body 37, and exposes the toner discharge port 377 to the outside. The slide movement of the shutter 30S is interlocked with the operation of loading the toner container 30 onto the developing apparatus 20.

The holding part 37L (FIG. 9) is a protrusion that is provided protrusively along the lateral direction in the rear side portion of the top plate 372 of the container main body 37. The holding part 37L is held by a user. The filling port 37G is formed in a cylindrical shape that is provided protrusively to the right side from the right wall 375. The cylindrical inside of the filling port 37G is formed so as to penetrate the right wall 375 along the first direction. The filling port 37G communicates between the outside of the container main body 37 and the storing space 37S. At the stage of manufacturing the toner container 30, the toner is filled into the storing space 37S from the filling port 37G.

The main body bearing part 37J is a bearing that is formed in the right wall 375. The main body bearing part 37J is formed in a cylindrical shape that is protruded rightward from the central part of the right wall 375. Referring to FIG. 10, the main body bearing part 37J is provided with a larger-diameter part 37J1 and a smaller-diameter part 37J2. The larger-diameter part 37J1 is a cylindrical part that is provided protrusively to the right side from the right wall 375. The smaller-diameter part 37J2 is connected to the right end part of the larger-diameter part 37J1, being a cylindrical part that is smaller in diameter than the larger-diameter part 37J1. Into the main body bearing part 37J, the shaft 33 is inserted. At this time, the right end side of the shaft 33 is protruded to the outside of the container main body 37. Further, in the cylindrical inside of the main body bearing part 37J, between the main body bearing part 37J and the shaft 33, a part of the stirring member 35 (a stirring bearing part 351) is inserted.

The filling port cap 30K (FIG. 13A) is loaded onto the filling port 37G of the container main body 37, sealing the filling port 37G. After the toner having been filled into the storing space 37S from the filling port 37G, the filling port cap 30K is loaded onto the filling port 37G, and welded thereto. As a result of this, the toner is prevented from being leaked from the filling port 37G.

The moving wall 32 is a wall part that is disposed, being faced to the first direction in the inside (the internal space 37H) of the container main body 37. The moving wall 32 defines an end face on the one end side of the first direction (a left end face) of the storing space 37S. An end face on the other end side of the first direction (a right end face) of the storing space 37S is defined by the right wall 375. In addition, the moving wall 32 has a function to move the toner in the inside of the internal space 37H in the first direction from an initial position on the one end side to a final position on the other end side of the first direction, while conveying the toner in the storing space 37S toward the toner discharge port 377, from the time of starting the use of the toner container 30 to the time of ending thereof. In the present embodiment, the initial position of the moving wall 32 is located on the right side of the lid part 31 (on the first direction downstream side), while the final position is located right on the left side (the first direction upstream side) of the toner discharge port 377.

Referring to FIG. 10 to FIG. 12, the moving wall 32 is provided with a conveying wall part 320, an outer peripheral wall part 321, a guide rib 320A (FIG. 12), an internal rib 320B

(FIG. **11**), a cylindrical part **320**C, an inner wall seal **322** (a sealing member), a shaft seal **323**, a bearing part **32**J (FIG. **10**), and an outer peripheral part **32**K.

The conveying wall part **320** is a wall part that defines the storing space **37**S together with the inner peripheral part **37**K of the container main body **37**. Particularly, the conveying wall part **320** is provided with a conveying face **320**S, which is perpendicular to the shaft **33**. The conveying face **320**S conveys the toner inside of the storing space **37**S, while pressing it, as the moving wall **32** is moved. In the present embodiment, the conveying face **320**S is provided with a tapered face **320**T (FIG. **10** and FIG. **12**).

The bearing part **32**J is a bearing part that is formed substantially in the central part of the conveying wall part **320**. The bearing part **32**J is moved along the first direction while holding the moving wall **32**. The below-described shaft **33** is inserted into this bearing part **32**J.

The cylindrical part **320**C is a cylindrical portion of the conveying wall part **320** that is provided protrusively to the first direction upstream side from a face on the opposite side of the conveying face **320**S. The cylindrical part **320**C forms a part of the bearing part **32**J. The cylindrical part **320**C is provided with a female spiral part **320**D. The female spiral part **320**D is a spiral-shaped screw part that is formed on the inner circumferential face of the cylindrical part **320**C. The female spiral part **320**D has a function to move the moving wall **32** along the first direction by engaging with a below-mentioned male spiral part **333** of the shaft **33**.

The outer peripheral wall part **321** is a wall part that is provided protrusively from the entire outer peripheral edge of the conveying wall part **320** toward the opposite side of the storing space **37**S, i.e., the moving direction upstream side (the first direction upstream side) of the moving wall **32**. The outer peripheral wall part **321** is disposed, being opposed to the inner peripheral part **37**K of the container main body **37**. The guide rib **320**A is a rib member that is extendedly provided along the first direction on the outer peripheral wall part **321**. A plurality of guide ribs **320**A are disposed on the peripheral face of the outer peripheral wall part **321** at intervals in a circumferential direction of rotation of the shaft **33**. The guide rib **320**A has a function to slightly contact with the inner peripheral part **37**K of the container main body **37**, thus suppressing the moving wall **32** from being inclined with respect to the shaft **33** in the inside of the container main body **37**. The internal rib **320**B is a rib that connects between the outer circumferential face of the cylindrical part **320**C and the inner peripheral face of the outer peripheral wall part **321** as shown in FIG. **11**. A plurality of internal ribs **320**B are disposed along the circumferential direction.

The inner wall seal **322** is a sealing member that is disposed on the side of the conveying wall part **320** of the outer peripheral wall part **321** so as to cover the periphery of the conveying wall part **320**. The inner wall seal **322** is an elastic member that is formed of an urethane sponge. The inner wall seal **322** is compressively deformed between the inner peripheral part **37**K of the container main body **37** and the moving wall **32**. In addition, the inner wall seal **322** forms the outer peripheral part **32**K of the moving wall **32**. The outer peripheral part **32**K is disposed, being tightly contacted with the inner peripheral part **37**K of the container main body **37**. The inner wall seal **322** prevents the toner in the storing space **37**S from flowing out from between the inner peripheral part **37**K of the container main body **37** and the moving wall **32** to the moving direction upstream side of the moving wall **32**. The above-mentioned guide rib **320**A is disposed on the first direction upstream side of the inner wall seal **322**.

The shaft seal **323** is fixed on the distal end side of the moving direction of the moving wall **32** of the female spiral part **320**D in the bearing part **32**J (FIG. **10**). The shaft seal **323** is an elastic member that is formed of an urethane sponge. The shaft seal **323** is contacted with the male spiral part **333** earlier than the female spiral part **320**D to clean the toner that has been stuck to the male spiral part **333**. Therefore, it is suppressed that the toner is aggregated between the male spiral part **333** and the female spiral part **320**D, whereby stable movement of the moving wall **32** can be achieved. In addition, the shaft seal **323** has a ring shape, thereby being tightly contacted with the shaft **33** over the entire circumference of the shaft **33**. Therefore, it is prevented that the toner in the storing space **37**S flows out to the moving direction upstream side of the moving wall **32**, passing through the bearing part **32**J.

The shaft **33** is rotatably supported by the right wall **375** and the lid part **31** of the container main body **37** so as to extend in the first direction in the internal space **37**H. The shaft **33** is provided with a first shaft end part **331**, a second shaft end part **332**, a male spiral part **333**, a moving wall stopping part **334**, a moving wall supporting part **335**, and a shaft flange **336**.

Referring to FIG. **9** and FIG. **10**, the first shaft end part **331** is a distal end part of the shaft **33** that penetrates the main body bearing part **37**J, being protruded to the right side. As shown in FIG. **9**, on the peripheral face of the first shaft end part **331**, a pair of D faces are formed. With the first shaft end part **331**, a second gear **382**, which is provided with a D-hole shape in the central part, is engaged. As a result of this, the shaft **33** and the second gear **382** are made integrally rotatable. The second shaft end part **332** is a left end part of the shaft **33**. The second shaft end part **332** is pivotally supported by the lid shaft hole part **31**J, which is formed in the lid part **31**.

The male spiral part **333** is a spiral-shaped screw part that is formed on the outer circumferential face of the shaft **33** in the internal space **37**H. As shown in FIG. **10**, in the present embodiment, the male spiral part **333** is disposed from a region of the shaft **33** that is adjacent to the lid part **31** to a region that is on the upstream side of the toner discharge port **377** in the first direction (the direction of arrow DA in FIG. **10**).

The moving wall stopping part **334** is disposed consecutively to the male spiral part **333** on the first direction downstream side thereof. The moving wall stopping part **334** is a region where the male spiral part **333** is partially lost from the shaft **33** in the internal space **37**H to provide only the shaft portion. The moving wall stopping part **334** is located above the toner discharge port **377**, and on the first direction upstream side of the toner discharge port **377**.

The moving wall supporting part **335** is disposed on the first direction downstream side of the moving wall stopping part **334**. The moving wall supporting part **335** is a protruding part that is provided protrusively in a radial direction from the circumferential face of the shaft **33**. The moving wall supporting part **335** has a function to support the bearing part **32**J when the moving wall **32** has reached the final position, thus suppressing the conveying face **320**S of the moving wall **32** from being inclined with respect to the first direction (inclined with respect to the shaft **33**).

The shaft flange **336** is disposed on the first direction downstream side of the moving wall supporting part **335** with a spacing being given therebetween. The shaft flange **336** is a disk-like flange that is provided protrusively in a radial direction from the circumferential face of the shaft **33**. Two shaft flanges **336** are disposed so as to be adjacent to each other in the first direction. The shaft flange **336** on the downstream

side has a function to compress the first seal **34** (FIG. **10**) together with a below-mentioned stirring cylindrical part **354** of the stirring member **35** (FIG. **11**). On the other hand, the shaft flange **336** on the upstream side has a function to suppress the toner from getting in the inside of the stirring cylindrical part **354**.

The first seal **34** is a ring-shaped sealing member that is disposed, being compressed between the shaft flange **336** of the shaft **33** and a side face of the stirring cylindrical part **354** of the stirring member **35**, as described above. The first seal **34** is formed of a sponge material. The first seal **34** prevents the toner from being leaked to the outside of the container main body **37**, passing between the inner circumferential face of the stirring bearing part **351** (FIG. **10**) of the stirring member **35** and the circumferential face of the shaft **33**.

The stirring member **35** (FIG. **9** and FIG. **10**) is disposed above the toner discharge port **377** along the right wall **375**. The stirring member **35** stirs the toner in the storing space **37**S, and delivers the toner from the toner discharge port **377**. In the present embodiment, the stirring member **35** is rotated around the shaft **33** and relatively to the shaft **33**. In FIG. **11**, the stirring member **35** is rotated in a direction of arrow DB. The stirring member **35** is provided with a stirring bearing part **351**, a stirring supporting part **352**, a stirring blade **353**, and a stirring cylindrical part **354** (FIG. **10** and FIG. **11**).

The stirring bearing part **351** is formed in a cylindrical shape that is fitted over the shaft **33**. The stirring bearing part **351** is inserted from the side of the storing space **37**S of the container main body **37** into the main body bearing part **37**J. As a result of this, the right end side of the stirring bearing part **351** is penetrated through the main body bearing part **37**J to be exposed to the outside of the container main body **37** beyond the right wall **375** (the main body bearing part **37**J). On the other hand, the left end side of the stirring bearing part **351** is disposed inside of the storing space **37**S. In the right end part of the stirring bearing part **351**, a first engaging part **35**K is formed (FIG. **9**). The first engaging part **35**K is engaged with a second engaging part **381**K, which is formed on the inner peripheral face of the first gear **381**. As a result of this, the stirring member **35** and the first gear **381** are integrally rotated.

The stirring supporting part **352** is a protruding piece that is provided protrusively in a radial direction of the shaft **33** from the left end side of the cylindrical stirring bearing part **351**. The stirring supporting part **352** is disposed along the right wall **375**, being faced to the first direction. The stirring supporting part **352** is rotated around the shaft **33** in the storing space **37**S. Particularly, in the present embodiment, a pair of stirring supporting parts **352** are disposed. In other words, one stirring supporting part **352** is disposed along the right wall **375** so as to extend radially toward the outside of the shaft **33**. In addition, the other stirring supporting part **352** is disposed so as to extend radially toward the outside from a location different from that of the above-mentioned one stirring supporting part **352** in a circumferential direction. In other words, the pair of stirring supporting parts **352** are disposed so as to extend toward the sides opposite to each other in a radial direction, being provided with a propeller shape in which the width in a circumferential direction is set to be increased in a radial direction toward the outside. Therefore, as compared to the case where the stirring supporting part **352** is formed in a disk shape, the toner that gets in the clearance between the stirring supporting part **352** and the right wall **375** is easy to be moved, thereby the toner being prevented from being aggregated.

The stirring blade **353** is a blade member that is provided protrusively from a pair of stirring supporting parts **352** toward the left side (the first direction upstream side). As shown in FIG. **11** and FIG. **12**, two stirring blades **353** are provided protrusively from each stirring supporting part **352**. The stirring blade **353** is provided with an L shape in a sectional view intersecting perpendicularly with the axial direction of the shaft **33** (see FIG. **13**B). The stirring blade **353** orbits above the toner discharge port **377**, while stirring the toner around the toner discharge port **377**, and discharging the toner from the toner discharge port **377**.

The stirring cylindrical part **354** is a portion of the stirring bearing part **351** that is on the left side of the stirring supporting part **352**. The outside diameter of the stirring cylindrical part **354** is set to be larger than the outside diameter of the stirring bearing part **351** on the right side of the stirring supporting part **352**. As shown in FIG. **10**, in the inside of the stirring cylindrical part **354**, the first seal **34** is disposed, being compressed.

Referring to FIG. **13**A and FIG. **13**B, in the present embodiment, when the right wall **375** is viewed from the first direction upstream side (the left side, i.e., this side of a paper face on FIG. **13**B), the stirring member **35** is provided with a shape that causes the filling port **37**G to be exposed in a specific turned position of the stirring member **35** around the shaft **33**. More specifically, as shown in FIG. **13**B, when the stirring member **35** is disposed in a specific turned position around the shaft **33**, the filling port **37**G is exposed between one stirring supporting part **352** and the other stirring supporting part **352** in a circumferential direction. Therefore, even if the stirring member **35** is made capable of being rotated in any position along the right wall **375**, by adjusting the turned position of the stirring member **35** as shown in FIG. **13**B, the toner can be smoothly filled into the storing space **37**S through the filling port **37**G.

The second seal **36** (FIG. **9** and FIG. **10**) is a ring-shaped sealing member that is disposed in the inside of the larger-diameter part **37**J**1** of the container main body **37**. The second seal **36** is disposed, being compressed between a stepped part between the larger-diameter part **37**J**1** and the smaller-diameter part **37**J**2** of the main body bearing part **37**J, and a ring-shaped protrusion that is formed on a right side face of the stirring supporting part **352** of the stirring member **35**. The second seal **36** is formed of a sponge material. The second seal **36** prevents the toner from being leaked to the outside of the container main body **37**, passing between the outer circumferential face of the stirring bearing part **351** of the stirring member **35** and the inner circumferential face of the main body bearing part **37**J.

The first gear **381** transmits a rotational driving force to the stirring member **35**. The first gear **381** is connected to the second motor M**2** through the first transmission gear **211** and the second transmission gear **212** of the developing apparatus **20** (FIG. **7**). In the present embodiment, the first gear **381** is rotationally driven in synchronization with the developing roller **21**, the first stirring screw **23**, and the second stirring screw **24** of the developing apparatus **20**. The first gear **381** is connected to the stirring bearing part **351** of the stirring member **35**, which has penetrated the main body bearing part **37**J. As a result of this, the first gear **381** and the stirring member **35** are integrally rotated. On the circumferential face of the first gear **381**, a plurality of gear teeth are provided.

The second gear **382** transmits a rotational driving force to the shaft **33**. Also on the circumferential peripheral face of the second gear **382**, a plurality of gear teeth are provided. The second gear **382** is connected to the first motor M**1** through the third transmission gear **213** (FIG. **7**). As shown in FIG. **10**, the right end part of the shaft **33** is disposed so as to penetrate the stirring bearing part **351** of the stirring member **35**. The

second gear **382** is connected (fixed) to the distal end part (the first shaft end part **331**) of the shaft **33**, which has penetrated the stirring bearing part **351**.

The cover **39** is loaded onto the protruding wall **376** of the container main body **37**. The cover **39** has a function to expose a part of the first gear **381** and the second gear **382** in a circumferential direction to the outside, and to cover the other portion of the first gear **381** and the second gear **382** in the circumferential direction. Referring to FIG. **10**, the cover **39** is provided with a second guide part **391** and an opening part for gear **39**K.

The second guide part **391** is a protruding part that is provided protrusively to the right side along a vertical direction on a side face on the right side of the cover **39**. The second guide part **391** has a function to guide the toner container **30** to be loaded onto the developing apparatus **20** together with the first guide part **312** of the lid part **31**.

The opening part for gear **39**K is an opening part with which a bottom face part of the cover **39** is opened in a semi-circular arc shape. With the cover **39** being loaded onto the container main body **37**, a part of the gear teeth of the first gear **381** and the second gear **382** is exposed to the outside of the toner container **30** through the opening part for gear **39**K. As a result of this, when the toner container **30** is loaded into the developing housing **210** of the developing apparatus **20**, the first gear **381** and the second gear **382** are engaged with an electromagnetic clutch that is connected to the second transmission gear **212**, and the third transmission gear **213** (FIG. **7**), respectively.

The toner sensor TS (FIG. **8**B) is a sensor that is disposed in the bottom part **371** of the container main body **37**. The toner sensor TS is disposed adjacent to the toner discharge port **377** in a circumferential direction, and in the present embodiment, is fixed to the lowest face part of the bottom part **371**. The toner sensor TS is a sensor comprised of a magnetic permeability sensor or a piezoelectric element. In the case where the toner sensor TS is comprised of a piezoelectric element, a sensor portion of the toner sensor TS is exposed to the storing space **37**S. The toner sensor TS outputs a HIGH signal (+5V) when being pressed by the toner in the storing space **37**S. In addition, if there is practically no toner on the toner sensor TS, the toner sensor TS outputs a LOW signal (0V). The output signal of the toner sensor TS is referenced by the control part **500** (FIG. **7**). In the case where the toner sensor TS is a magnetic permeability sensor, the sensor need not be directly contacted with the toner. Therefore, in another embodiment, the toner sensor TS may be disposed on the side of the developing housing **210** of the developing apparatus **20** so as to be opposed to the outside wall of the container main body **37**. Further, the location of the toner sensor TS is not limited to the bottom part **371**. In another embodiment, the toner sensor may be disposed on such a part as the top plate **372**, the front wall **373**, or the rear wall **374** of the container main body **37**.

<About Movement of Moving Wall>

While the first guide part **312** of the lid part **31** and the second guide part **391** of the cover **39** being guided by the pair of guide grooves **109**A of the developing apparatus **20**, the toner container **30** is loaded into the container accommodating part **109** by the user (FIG. **6** and FIG. **7**). When the toner container **30** is loaded into the container accommodating part **109**, the shutter **30**S is moved, the toner discharge port **377** being opened. As a result of this, the toner discharge port **377** is disposed above the toner replenishing port **25**, being opposed thereto (FIG. **4** and FIG. **5**).

FIG. **14**A is a sectional view showing the state in which the moving wall **32** has been positioned in a final position in the toner container **30**. FIG. **14**B is an enlarged sectional view showing the state in which the moving wall **32** has been positioned in the final position in the toner container **30**. FIG. **10**, which is given above, is a sectional view showing the state in which the moving wall **32** has been moved half way from the initial position in the first direction. The initial position of the moving wall **32** is set at a position along the lid part **31**, i.e., on the left side of the position of the moving wall **32** that is shown in FIG. **10**.

When a new toner container **30** is loaded onto the printer **100**, the control part **500** (FIG. **7**) drives the first motor M**1** to rotationally drive the shaft **33** through the second gear **382**, which is engaged with the third transmission gear **213**. As a result of this, on the basis of the engagement of the male spiral part **333** of the shaft **33** with the female spiral part **320**D of the moving wall **32**, the moving wall **32** is moved toward the toner discharge port **377** in the first direction (a direction of arrow DA in FIG. **10**). Then, when the moving wall **32** has been moved rightward from the initial position by a specific distance, the storing space **37**S is filled with the toner, the toner sensor TS outputting a HIGH signal according to the filled state. The control part **500** stops the moving wall **32** in response to the HIGH signal that has been outputted by the toner sensor TS.

In the present embodiment, when viewed from the section crossing with the first direction, the inner peripheral part **37**K of the container main body **37** and the outer peripheral part **32**K of the moving wall **32** are in a non-complete round shape. In addition, the outer peripheral part **32**K of the moving wall **32**, which is tightly contacted with the inner peripheral part **37**K of the container main body **37**, is provided with a shape analogous to the inner peripheral part **37**K. Therefore, even in the case where, on the basis of the engagement of the male spiral part **333** with the female spiral part **370**D, the moving wall **32** is provided with a rotational force around the shaft **33**, it is prevented that the moving wall **32** is rotated (co-rotated) around the shaft **33**. As a result of this, with the rotational driving force of the first motor M**1**, the moving wall **32** can be moved in a stable manner in the first direction.

As described above, in the present embodiment, as shown in FIG. **5**, the toner replenishing form of volume replenishment type has been adopted. Therefore, in the case where the retaining part **29** (FIG. **5**) on the side of the developing apparatus **20** seals the toner replenishing port **25** from under, the replenishing toner will not be dropped from the toner container **30**. On the other hand, when the toner is supplied from the developing roller **21** to the photosensitive drum **121** of the developing apparatus **20**, thereby the quantity of the toner in the retaining part **29** being decreased, the toner will flow into the developing apparatus **20** from the toner discharge port **377** through the toner replenishing port **25**. As a result of this, in the storing space **37**S of the toner container **30**, the toner around the toner sensor TS is lost, thereby the toner sensor TS outputting a LOW signal. In response to the signal, the control part **500** drives the first motor M**1** to further move the moving wall **32** toward the toner discharge port **377** until the toner sensor TS outputs a HIGH signal.

In accordance with the developing operation in the developing apparatus **20**, the control part **500** drives the second motor M**2** to rotationally drive the developing roller **21**, and the like. In interlocking with this rotational operation, the stirring member **35** is rotated through the first gear **381**, which is engaged with the second transmission gear **212**. As a result of this, the stirring member **35**, which is disposed on the right end side of the storing space **37**S is rotated around the shaft **33**, thereby the toner above the toner discharge port **377** being stirred in a stable manner. Therefore, the fluidity of the toner

is increased, and thus the toner is dropped from the toner discharge port **377** in a stable manner. Particularly, in the present embodiment, the stirring blade **353** is provided protrusively from the stirring supporting part **352** of the stirring member **35**. Therefore, by the orbiting motion of the stirring blade **353**, the toner around the toner discharge port **377** is positively stirred.

When the printing operation is repeated, thereby the toner in the storing space **37**S in the toner container **30** being continued to be used, the moving wall **32** will eventually reach the final position shown in FIG. **14**A. In this way, with the moving wall **32** being gradually moved in the first direction, the toner in the storing space **37**S is conveyed to the toner discharge port **377**, while being pressed by the moving wall **32**. At this time, until the moving wall **32** reaches the final position, the storing space **37**S is gradually reduced. Therefore, in the inside of the toner container **30**, the space itself in which the toner remains is gradually lost. As a result of this, in comparison with a typical toner container with which the volume of the storing space will not be changed, the quantity of toner that remains in the storing space **37**S in the container main body **37** at the time of termination of the use is reduced.

In the present embodiment, as shown in FIG. **14**A, the final position of the moving wall **32** where the moving wall **32** is stopped is set slightly on the first direction upstream side of the toner discharge port **377**. More specifically, referring to FIG. **14**B, when, with the moving wall **32** being moved, the bearing part **32**J of the moving wall **32** reaches the moving wall stopping part **334**, the engagement of the male spiral part **333** with the female spiral part **320**D is released. As a result of this, transmission of the moving force from the shaft **33** to the moving wall **32** is interrupted, the moving wall **32** being stopped in the final position. At this time, there is left a space above the toner discharge port **377**, a slight quantity of toner remains in that space. However, in the present embodiment, with the stirring member **35** being rotationally driven, the toner can be discharged from the toner discharge port **377** in a stable manner to the last. The toner discharge port **377** is opened in a location that is displaced slightly upward from the lower end part of the container main body **37**. Even in such a case, the toner remaining in the lowest end part of the container main body **37** will be scooped up by the stirring blade **353** (FIG. **11**), and then discharged from the toner discharge port **377** in a stable manner.

Further, referring to FIG. **14**A, in the final position of the moving wall **32**, the conveying face **320**S of the moving wall **32** is located with a spacing being provided on the first direction upstream side with respect to the stirring blade **353** of the stirring member **35**. Therefore, it is prevented that there occurs an interference between the conveying face **320**S of the moving wall **32**, which has reached the final position, and the stirring member **35**. In addition, in the final position of the moving wall **32** that is shown in FIG. **14**A, the inner wall seal **322** of the moving wall **32** urges the inner peripheral part **37**K of the toner container **30** in the radial direction from the inside with an elastic force. Therefore, the moving wall **32** is locked in the final position in a stable manner, thus the moving wall **32** being prevented from approaching the side of the stirring member **35**. In another embodiment, the stirring member **35** may not be provided with the stirring blade **353**, and the final position of the moving wall **32** may be set such that the moving wall **32** blocks the toner discharge port **377** from the inside.

Further, FIG. **15** is a schematic sectional view for explaining the tapered shape of the inner peripheral part **37**K of the container main body **37** of the toner container **30** according to the present embodiment. In FIG. **15**, a part of the toner container **30** and that of the developing apparatus **20** are shown. In addition, in order to simplify the explanation, in FIG. **15**, the shape of a cross section orthogonal to the first direction of the moving wall **32** is assumed to be circular. Actually, the cross sectional shape of the moving wall **32** is substantially a polygonal shape as shown in FIG. **11** and FIG. **12**. In addition, in FIG. **15**, the initial position of the moving wall **32** is indicated with a symbol **32**P**1**, and it is shown that, with the moving wall **32** being moved in the first direction, the moving wall **32** is sequentially moved to the positions indicated with symbols **32**P**2** and **32**P**3**. In addition, in FIG. **15**, the conveying capacity suppressing part in the developing apparatus **20** is formed by the first spiral blade **23***b* of the first stirring screw **23** being partially reduced in size (a size-reduction part **28**A). Even in this case, as with the suppressing paddle **28** (FIG. **5**), the retaining part **29** for toner is formed around the toner replenishing port **25**. The size-reduction part **28**A may be formed by partially removing the first spiral blade **23***b*.

In the present embodiment, as shown in FIG. **15**, the cross-sectional area of the internal space **37**H of the container main body **37** in a sectional view intersecting perpendicularly with the first direction (see the arrow in FIG. **15**) is set so as to be decreased as the final position of the moving wall **32** is approached. Particularly, the cross-sectional area of the internal space **37**H is set so as to be decreased along the first direction from the initial position to the final position of the moving wall **32**. For this change in cross-sectional area of the internal space **37**H, the outer peripheral part of the container main body **37** and the inner peripheral part **37**K thereof are slightly tapered from the left end part to the right end part of the container main body **37**.

When, with the use of the toner container **30**, the moving wall **32** is moved in the first direction, the inner peripheral part **37**K of the container main body **37** and the inner wall seal **322** of the moving wall **32** rub each other. Therefore, there is the possibility that the sealability of the inner wall seal **322** may be gradually lowered. Even in such a case, according to the configuration as described above, the inner peripheral part **37**K of the container main body **37** is disposed such that the distance between it and the axis of the shaft **33** is gradually reduced along the first direction. As a result of this, as the moving wall **32** is moved from the side of the lid part **31** to that of the right wall **375**, the amount of compression of the inner wall seal **322** is increased along the first direction, thereby the sealability of the inner wall seal **322** being maintained in a stable manner. Therefore, the toner in the storing space **37**S is suppressed from being leaked from between the inner peripheral part **37**K and the inner wall seal **322** to the internal space **37**H on the first direction upstream side of the moving wall **32**. Particularly, in the present embodiment, the cross-sectional area of the internal space **37**H is set so as to be decreased from the initial position to the final position of the moving wall **32** along the first direction. Therefore, the amount of compression of the inner wall seal **322** can be gradually (continuously) increased as the moving wall **32** is moved.

Referring to FIG. **15**, it is desirable that the taper angle θ**1** of the inner peripheral part **37**K be set in the range of 0.5 degrees to 10 degrees, and more desirably, the taper angle θ**1** is set in the range of 1 degree to 5 degrees. If the taper angle θ**1** exceeds 10 degrees, the amount of compression of the inner wall seal **322** is large, thereby the frictional force between the inner peripheral part **37**K and the inner wall seal **322** being increased. In this case, the rotating torque for rotating the shaft **33** to move the moving wall **32** is excessively increased, thereby the first motor M**1** (FIG. **7**) being required to have a large driving torque. In addition, in the case

where the taper angle θ1 is under 0.5 degrees, the amount of compression of the inner wall seal **322** becomes difficult to be increased along the first direction.

Further, in the present embodiment, as described above, the toner replenishment technique of volume replenishment type has been adopted. In other words, in accordance with the quantity of toner in the retaining part **29** (FIG. **5**) of the developing apparatus **20**, the toner is replenished from the toner container **30** to the developing housing **210** of the developing apparatus **20**. Referring to FIG. **15**, in the case where the moving wall **32** is located in the initial position **32**P**1** or the moving position **32**P**2**, a sufficient quantity of toner is stored in the storing space **37**S, thereby the space above the toner discharge port **377** being filled with toner with the moving wall **32** being moved. However, when the moving wall **32** is located in the moving position **32**P**3** or the final position, the quantity of toner that is stored above the toner discharge port **377** is small in comparison to that which is provided when the moving wall **32** is in the initial position.

In this case, the pressing force with which the replenishing toner remaining in the storing space **37**S of the toner container **30** presses the toner in the retaining part **29** in the developing housing **210** from upward to downward tends to be weakened. As a result of this, the dropped quantity of replenishing toner is decreased. According to the above configuration, the cross-sectional area of the internal space **37**H is set so as to be decreased toward the final position of the moving wall **32**. Therefore, the rate of decrease in volume of the storing space **37**S is enhanced in the vicinity of the toner discharge port **377**, the density of toner in the storing space **37**S being increased. In other words, due to the moving wall **32** being moved in the first direction, the toner density in the storing space **37**S is maintained substantially constantly. Therefore, even in the case where the moving wall **32** approaches the final position, the pressing force with which the replenishing toner presses downward the toner in the retaining part **29** of the developing housing **210** is kept unchanged, thereby the replenishing toner flowing into the side of the developing housing **210** in a stable manner in accordance with the decrease in the quantity of toner in the retaining part **29**. As a result of this, the toner in the toner container **30** is supplied to the developing apparatus **20** in a stable manner to the last.

As described above, when the moving wall **32** is moved from the side of the lid part **31** toward the side of the right wall **375**, the inner peripheral part **37**K is gradually reduced in diameter from the opening part on the left side of the container main body **37** toward the right wall **375**, and on the basis of such reduction, the cross-sectional area of the internal space **37**H is set. In the present embodiment, the container main body **37** is formed of a resin material, and is produced by the mold molding technique, thereby the cross-sectional area of the internal space **37**H being efficiently set. Specifically, the mold to mold the container main body **37** includes a cylindrical first mold (not shown) that is provided with a recessed part to form the outer peripheral face of the container main body **37**, and a columnar second mold (not shown) that is inserted into the recessed part of the first mold in the first direction to form the inner peripheral part **37**K of the container main body **37**. After a resin material being filled between the first mold and the second mold, and cured, the second mold is drawn out from the recessed part toward a direction opposite to the first direction. The inner peripheral face of the first mold is provided with a draft angle that is known. In drawing out the second mold, a taper along the first direction is formed in the inner peripheral part **37**K of the container main body **37**, thereby the cross-sectional area of the internal space **37**H of the container main body **37** being set so as to be decreased as the final position of the moving wall **32** is approached. Thus, at the time of resin molding of the container main body **37**, the change in cross-sectional area of the internal space **37**H along the first direction can be set. The inner peripheral face of the first mold may be provided with an inclination angle larger than the draft angle.

Herein above, the printer **100** according to the embodiment of the present disclosure has been explained. According to such a configuration, in the printer **100**, it is suppressed that, with the moving wall **32** being moved, the toner is leaked to the moving direction upstream side of the moving wall **32**. On the other hand, the present disclosure is not limited to this, and, for example, a modified embodiment as described below can be adopted.

(1) In the above embodiment, the printer **100** has been explained by using a monochrome printer, however, the present disclosure is not limited to this. Particularly, in the case where the printer **100** is a tandem type color printer, after the opening/closing cover **100**C (FIG. **2**) of the printer **100** having been opened, the respective toner containers **30** corresponding to a plurality of colors of toner may be loaded into the casing **101** from above so as to be adjacent to one another.

(2) In addition, in the above embodiment, explanation has been made with an aspect in which the cross-sectional area of the internal space **37**H is set so as to be decreased from the initial position of the moving wall **32** to the final position along the first direction, however, the present disclosure is not limited to this. FIG. **16** is a schematic sectional view showing a taper of an inner peripheral part **37**KA of a container main body **37**A of a toner container **30**A according to the modified embodiment of the present disclosure. Also in FIG. **16**, for simplifying the explanation, the sectional shapes of the inner peripheral part **37**KA and the moving wall **32**A are shown as a circular one. Actually, like the embodiment as previously described, the sectional shape of the inner peripheral part **37**KA and the moving wall **32**A are non-circular.

On the outer peripheral part of the moving wall **32**A, an inner wall seal **322**A is disposed. Into the bearing part **32**J of the moving wall **32**A, a shaft **33**A is inserted. The moving wall **32**A is sequentially moved from an initial position **32**Q**1** on the side of a lid part **31**A to moving positions **32**Q**2** and **32**Q**3** in the first direction, reaching a final position on the side of a right wall **375**A, where a toner discharge port **377**A is opened. In the present modified embodiment, the internal space of the container main body **37**A is provided with a first region and a second region. The first region corresponds to a region from the initial position **32**Q**1** of the moving wall **32**A to the moving position **32**Q**3** in the container main body **37**A in FIG. **16**. In the first region, the cross-sectional area of the internal space along the first direction is set to be uniform. On the other hand, the second region is a region on the first direction downstream side of the moving position **32**Q**3** in the container main body **37**A in FIG. **16**. The second region is provided jointly with the first region on the first direction downstream side thereof, being set such that the cross-sectional area of the internal space is decreased at least to the final position of the moving wall **32**A along the first direction. In other words, as shown in FIG. **16**, in the second region, the inner peripheral part **37**KA is tapered, being provided with a taper angle of θ**2**.

According to such a configuration, in the first region, the amount of compression of the inner wall seal **322**A is set to be substantially constant, and in the second region, the amount of compression of the inner wall seal **322**A can be gradually increased. Therefore, at the final stage of movement of the moving wall **32**A, the amount of compression of the **322**A can be greatly increased. Therefore, to the last, backflow of the

toner to the first direction upstream side can be prevented. In addition, the filling rate of the toner in the storing space of the container main body **37**A can be enhanced in the vicinity of the toner discharge port **377**A, thereby the dropped quantity of toner from the toner discharge port **377**A being maintained in a stable manner. Referring to FIG. **16**, it is desirable that the taper angle θ**2** of the inner peripheral part **37**KA be set in the range of 0.5 degrees to 20 degrees, and more desirably, the taper angle θ**2** is set in the range of 1 degree to 10 degrees.

(3) In addition, in the above embodiment, explanation has been made with an aspect in which the moving wall **32** is moved from the side of the lid part **31** to the side of the right wall **375**, however, the present disclosure is not limited to this. There may be provided an aspect in which the toner discharge port **377** is opened on the side of the lid part **31**, and the moving wall **32** is moved from the side of the right wall **375** to the side of the lid part **31**. Further, the opening location of the toner discharge port **377** is not limited to the above-mentioned location. The toner discharge port **377** may be opened in the lowest end part of the bottom part **371**, or may be opened in still another location.

(4) In addition, in the above embodiment, explanation has been made with the toner replenishing form of volume replenishment type, the present disclosure is not limited to this. In the developing housing **210** of the developing apparatus **20**, a toner sensor (not shown) may be provided, and, in accordance with the output of the toner sensor, the moving wall **32** may be moved to replenish the toner from the toner container **30** to the developing apparatus **20**. In addition, the developing apparatus **20** is not limited to the one-component development system, and may be that which has adopted the two-component development system.

What is claimed is:

1. A developer storing container, comprising:

a container main body, being provided with an inner peripheral part, cylindrically extending along a first direction, and an internal space, being defined by the inner peripheral part,

a developer discharge port, being opened in a bottom face part of the container main body so as to be communicated with the inner peripheral part, and a developer being discharged therefrom,

a moving wall, being provided with an outer peripheral part, being disposed in tight contact with the inner peripheral part of the container main body, and a conveying face, defining a storing space together with the inner peripheral part of the container main body, the developer being stored therein; the moving wall being moved from an initial position on the one end side of said first direction to a final position on the other end side thereof in said internal space, while conveying said developer in said storing space toward said developer discharge port, and

a sealing member, forming the outer peripheral part of the moving wall, and being compressively deformed between the inner peripheral part of the container main body and the moving wall,

a cross-sectional area of the internal space of the container main body in a sectional view intersecting perpendicularly with the first direction being set so as to be decreased as the final position of the moving wall being approached.

2. The developer storing container according to claim **1**, wherein the cross-sectional area of the internal space is set so as to be decreased from the initial position of the moving wall to the final position along the first direction.

3. The developer storing container according to claim **1**, wherein the internal space of the container main body has

a first region where the cross-sectional area is uniform over a prescribed distance along the first direction from the initial position of the moving wall, and

a second region that is provided jointly with the first region on the first direction downstream side thereof, the cross-sectional area being decreased along the first direction to the final position of the moving wall.

4. The developer storing container according to claim **1**, wherein the container main body is provided with a wall part, defining an end face of the internal space on the other end side of the first direction,

further having a lid part, being loaded at an end part of the container main body on the opposite side of the first direction of the wall part, blocking the internal space,

the developer discharge port being opened on the side of the wall part in a bottom face part of the container main body, and

the moving wall being moved from an initial position on the side of the lid part to a final position on the side of the wall part.

5. The developer storing container according to claim **4**, wherein the container main body is produced by resin molding,

with a mold for molding, being provided with a first mold, having a cylindrical recessed part to form an outer peripheral face of the container main body, and a second mold, being inserted into the recessed part of the first mold in the first direction to form the inner peripheral part of the container main body; upon the second mold being drawn out from the recessed part, a taper along the first direction being formed in the inner peripheral part of the container main body, thereby the cross-sectional area of the internal space of the container main body being decreased as the final position of the moving wall being approached.

6. An image forming apparatus, comprising:

the developer storing container according to claim **1**,

an image carrier, an electrostatic latent image being formed on a surface thereof and carrying a developer image thereon,

a developing apparatus, the developer being replenished from the developer storing container thereto, and supplying the developer to the image carrier, and

a transfer part, transferring the developer image from the image carrier to a sheet.

7. The image forming apparatus according to claim **6**, wherein the developing apparatus comprises:

a housing, being provided with a developer carrying passage, conveying the developer in a prescribed conveying direction,

a developer replenishing port, being opened in the housing under the developer discharge port, and receiving the developer into the developer carrying passage from the developer storing container,

a developer conveying member, being disposed in the developer carrying passage, and conveying the developer in the conveying direction, and

a conveying capacity suppressing part, being provided on the downstream side of the developer replenishing port in the conveying direction to partially suppress the capacity of the developer conveying member of conveying the developer toward the conveying direction.

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